The JOURNAL OF ELECTRICITY
POWER AND GAS
WITH WHICH IS INCORPORATED
The Engineers' Architects' and Builders' News

PUBLISHED WEEKLY

By the Technical Publishing Company, Atlas Building, 604 Mission Street, San Francisco Cal.
Entered as second-class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the Act of Congress March 3, 1879.

Vol. XVIII. No. 6 San Francisco, Cal., Feb. 9, 1907. Yearly subscription $2.50 Single copies 10 cents

OKONITE WIRE

The Standard for Rubber Insulation

Okonite Tape, Manson Tape,
Candee Weather-proof Wire,
Candee (Patented) Potheads.

THE OKONITE COMPANY, 253 BROADWAY, N. Y.

Standard Underground Cable Co.

—Manufacturers of—

Bare and Insulated Wires and Cables

All kinds for all services. Large stocks on hand at our Oakland Factory

PACIFIC COAST DEPARTMENT: BACON BLOCK, OAKLAND, CAL.

A. B. Saurman, Pacific Coast Manager

Sub Offices: San Francisco, Los Angeles, Seattle
Factories: Oakland, Cal., Pittsburgh, Pa., Perth Amboy, N. J.

Meese & Gottfried Company

19th and Harrison Sts., SAN FRANCISCO

Power Transmitting Machinery

Of all description. We have a larger stock of Shafting, Hangers, Boxes, Pulleys, etc., than ever.

Seattle *San Francisco* *Los Angeles*

VULCAN

Refrigerating and Ice Making Machinery

Manufactured by

Vulcan Iron Works, Cor. Kearny and Francisco Streets, San Francisco

INDIANA RUBBER AND INSULATED WIRE CO.

—MANUFACTURERS OF—

PARANITE AND PEERLESS RUBBER COVERED WIRES AND CABLES

Underground, Aerial, Submarine and Inside Use
TELEPHONE, TELEGRAPH AND FIRE ALARM CABLES
All Wires are Tested at Factory JONESBORO, IND.

ELECTRIC APPLIANCE CO.

315 Main St., San Francisco Pacific Coast Agents

San Francisco Los Angeles Oakland

HENSHAW, BULKLEY & CO.

ENGINEERS AND MACHINERY MERCHANTS

219-221 Spear St. San Francisco, Cal.

HALLIDIE MACHINERY CO.

Engineers and Machinery Merchants

Machine Tools, Foundry Equipment, Wood Working Machinery, Special Machinery

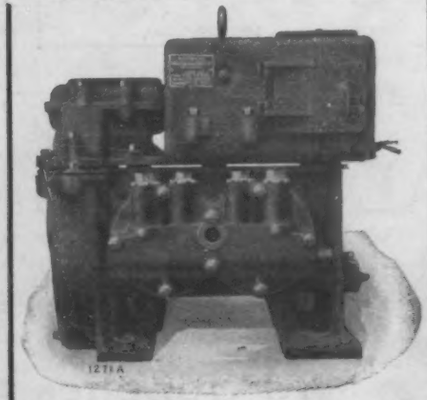
Main Office
315-317 Second Ave. South, Seattle.

Branch Office
502 First Ave., Spokane, Wash.

The National Conduit & Cable Co.

Manufacturers of
TROLLEY WIRE
BARE COPPER WIRE AND CABLES
WEATHERPROOF WIRES AND CABLES
PAPER-INSULATED CABLES
FOR TELEPHONE, TELEGRAPH AND POWER

703 MONADNOCK BUILDING, SAN FRANCISCO
C. H. PENNOYER, PACIFIC COAST MANAGER



Type A-4 National Compressor

NATIONAL

Motor-Driven Air Compressors

Built in Capacities of from 11 to 50 cu. ft. of Free Air per Minute
For Continuous or Intermittent Service

WRITE FOR BULLETINS

NATIONAL BRAKE AND ELECTRIC CO.

MILWAUKEE, WIS.

GENERAL SALES OFFICE, 519 FIRST NATIONAL BANK BUILDING, CHICAGO

PACIFIC COAST MANAGER, J. F. PERRY, ROOM 101, No. 203 TELEGRAPH AVE., OAKLAND, CAL.

Single Phase

WANTED

CAR LOADS OF MOTORS

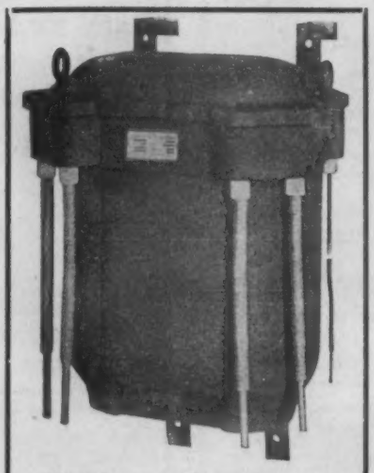
— AND —

TRANSFORMERS

that look as good and of as high efficiency and beautifully designed at

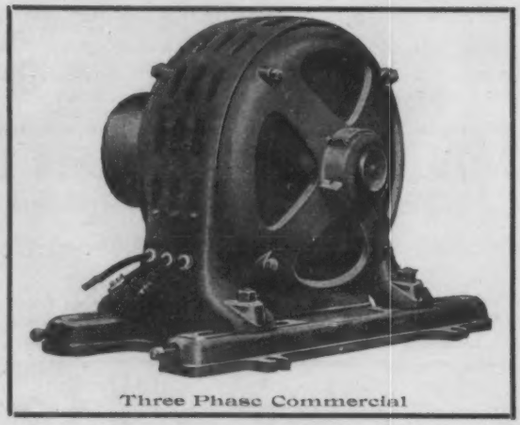
BETTER PRICES

than our THREE OF A KIND shown here.



Hornberger Transformer

If you have'nt used them write us and we'll tell you to whom to telegraph at our expense for testimonials of their superior qualities. We have them and all other kinds of eletcrical machinery and supplies in stock.



Three Phase Commercial

PACIFIC COAST AGENTS

STANDARD ELECTRICAL WORKS

58 & 60 Natoma Street — Phone, Temporary 894 — SAN FRANCISCO, CAL.

Jobbers of Electrical Machinery and Supplies

THE

Journal of Electricity, Power and Gas

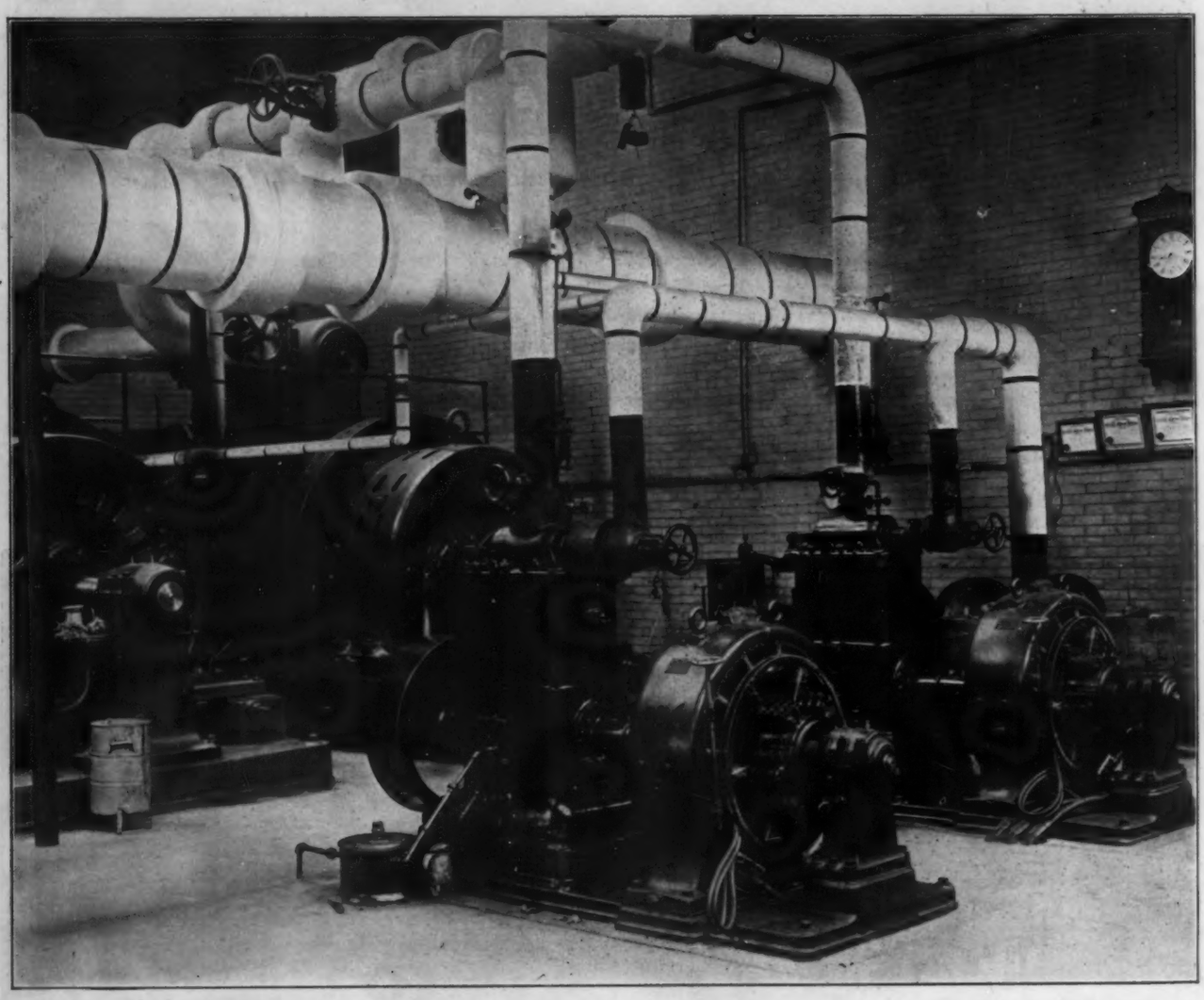
WITH WHICH IS INCORPORATED

The Engineers' Architects' and Builders' News

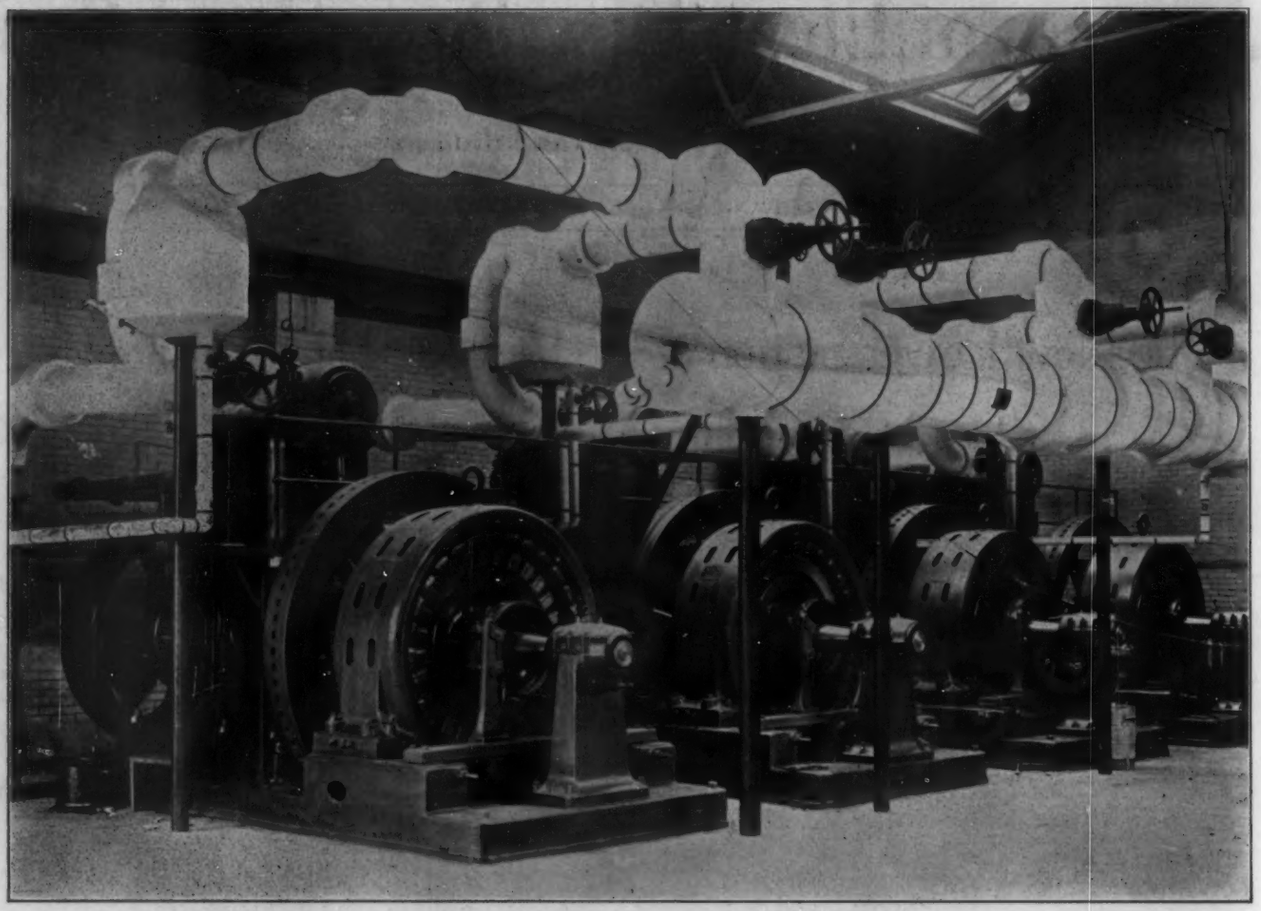
VOLUME XVIII. SAN FRANCISCO, CAL., FEBRUARY 9, 1907 No. 6

The New Power Station of the People's Light, Heat and Power Company, Springfield, Ohio.

The rapid progress made within the last few years in the design and construction of light and power stations is aptly illustrated by the new power house of the Peoples' Light, Heat & Power Company, at Springfield, Ohio. The building is of fire-proof construction and exceedingly well lighted and ventilated. The illustration of exterior shows the front and facing on West Jefferson Street. A spur from the P. C. C. & St. L. R. R. enters the building, providing a means for delivering coal on cars directly in the boiler room. Four Heine Safety boilers of 450 horsepower each furnish steam at 150



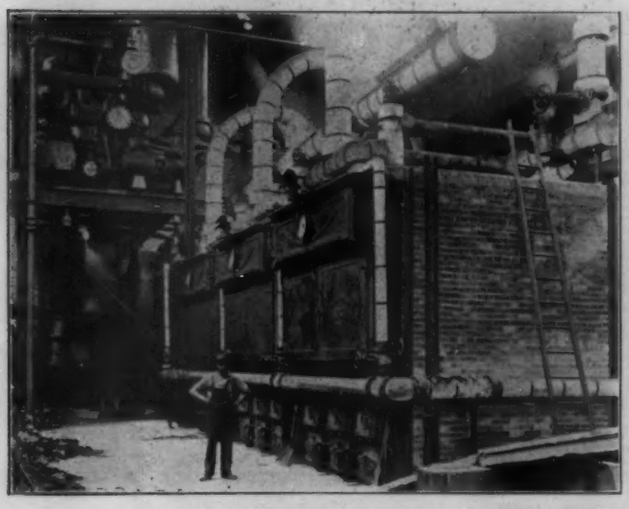
EXCITER UNITS IN FOREGROUND.



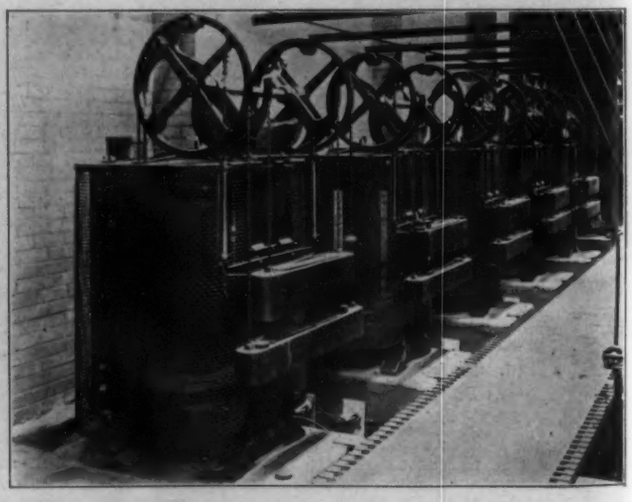
WESTINGHOUSE DIRECT CONNECTED GENERATORS.

pounds pressure to four Westinghouse automatic, compound, non-condensing engines of 400 horsepower each with cylinders 16x27-inch and 16-inch stroke, 257 revolutions per minute, which operate four 250-kilowatt, engine-type, revolving-field, two-phase, 60-cycle, 2,200 volt generators. Excitation is furnished by two 25-kilowatt, 125-volt, direct-current generators direct connected to two Westinghouse Junior automatic engines of 32 horsepower each, with 8x7-inch cylinders. These units are illustrated in Figure 4.

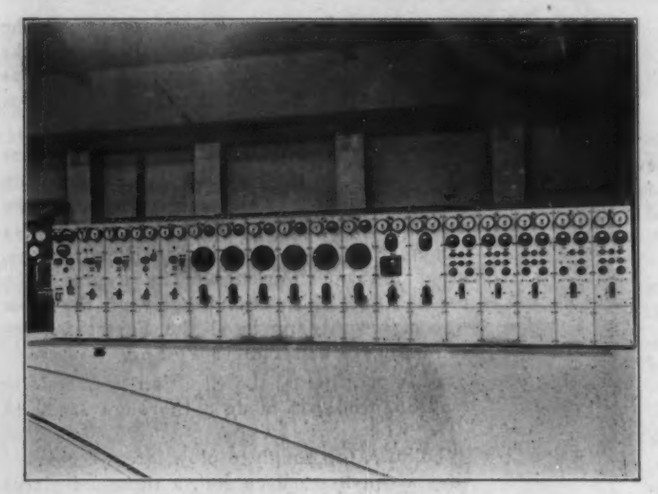
The switchboard is constructed of white Italian marble, and consists of eighteen panels as follows: One double exciter panel on which is mounted one voltmeter, two ammeters, two field rheostats, two double-pole knife switches and a voltmeter plug; four generator panels provided with two ammeters, field switch, rheostat, type-D oil switch and voltmeter receptacle; six feeder panels, on which are mounted an ammeter, single-phase integrating wattmeter, Stillwell regulator and type-J oil circuit breaker; two power panels,



BOILER ROOM.



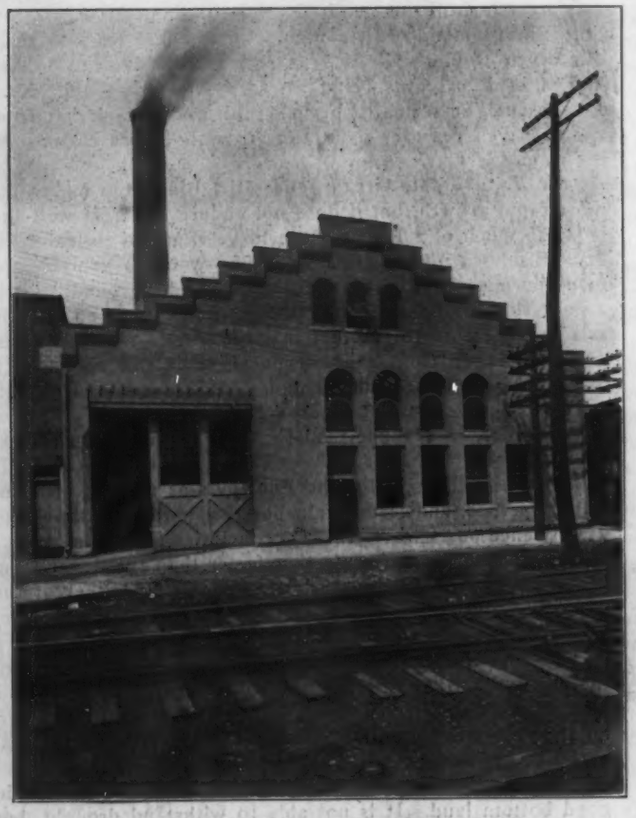
ARC LIGHT TRANSFORMER.



SWITCH BOARD.

each provided with two ammeters, a polyphase integrating wattmeter and type-F oil switch; four standard constant-current regulating transformer panels. A swinging bracket is provided on which are mounted two voltmeters and one synchroscope; this, with a Tirrell regulator, completes the switchboard equipment.

Immediately behind the switchboard are located five Westinghouse 100-light, two-circuit, air-cooled, constant-current regulating transformers, 2,200 volts primary, which furnish current for 378 series alternating-current arc lamps for street lighting, the Peoples' Light, Heat & Power Company having the contract for lighting the streets of the city.



EXTERIOR OF POWER HOUSE.

Aside from the city lighting, this company does a large commercial business, furnishing current for Nernst, incandescent and multiple arc lamps and motors.

The entire equipment of the power house is striking in its uniformity, which is a great contrast to the older stations where many different types of machines are generally found,

HYGIENIC ILLUMINATION.

The unfriendly have frequently contended that gas lighting was not healthful by reason of its vitiating the air of rooms, but they have yet to point out actual cases of positive injury resulting therefrom under normal conditions. The same cannot be said for electricity, for, although the incandescent bulbs do not deliver carbon dioxide into the air, they injure the eyes for the benefit of which they are used instead of assisting them, by reason of both insufficient illumination and the blinding glare of exposed filaments burning their images into the retina of the eye until the nerves are seriously affected. The customer who buys electric light finds it expensive, tries to economize and the invariable result is insufficient light. To get the most for his money he places the light near the thing to be illuminated, right in the range of vision where the glowing filament is generally impressed on the less used portion of the retina and serious eye fatigue results. This would not be so reprehensible if the customer himself were the only one affected by this attempt at economy, but he subjects his family, his patrons or school children to an enforced torture, those who are defenseless against this insiduous evil; eye strain results and often permanent injury.

If there is anything we need more than another it is our eyesight and a direct and strenuous attempt should be made by all interested in the lighting business to make the eye the first and only consideration in designing lighting installations. By avoiding sharp contrasts, making general illumination soft and uniform, keeping all intensely bright lights out of the line of vision and deriving local lighting from large lighting surfaces, much can be accomplished, but the subject should be thoroughly investigated at once and lighting rules adopted and put in force.

This is a subject for the Illuminating Engineering Society to handle. They have been running to electricity very largely, and it is to them we look for electric-lighting policy. They could very readily compile a set of lighting rules and see that these get into the hands of all lighting companies for consideration, revision or adoption. Carbon dioxide has been present in rooms since the days of cave dwellers, and we can put up with it a little longer, but these intensely glaring light sources are so recent as to have their evil effects not generally understood, and this is all the more reason that immediate attention should be paid to them.—From "Progressive Age."

AVOIDABLE ACCIDENTS.

The census for 1900 shows that during that year there were reported 57,513 deaths by accident and violence in the United States, with an accompanying number of non-fatal casualities many times greater. Without increase of the annual rate reported by the government in 1900, there will be 575,000 persons killed every ten years, besides some 5,000,000 injured, even if the proportion of accidents to the population should prove to be no greater in this country than that of France. According to President Strong of the Institute, this would be equivalent to massacring every inhabitant in three cities the size of Indianapolis, Kansas City, and Denver every ten years, and at the same time maiming and mangling every man, woman and child in Washington, Oregon, California, Nevada, Utah, New Mexico, Arizona, Colorado, Wyoming, Idaho, Montana and Oklahoma, and doing it every ten years.

EUCALYPTUS AS A HARDWOOD.*

By O. M. Boyle, Jr.

Although the Eucalypts are natives of Australia and the adjacent islands, their adaptability to varying conditions of soil, etc., provided the climate be semi-tropic, has favored their propagation throughout some other parts of the world, notably, California and Italy.

In Australia the different species (there are over 150 in all) occupy situations varying from deserts or dry, mountainous regions to low, swampy and moist mountainous ones. This fact has favored the introduction upon this continent of a great number of species. On the western coast, and particularly in the southern and central parts of California, Eucalyptus should be an important timber product. As yet, the value of the wood is not fully appreciated in this country, owing to the fact that it has been grown here only in comparatively recent years. The first trees to be planted were the Eucalyptus globulus, in 1856, but it was not until 1870 that any extensive forest planting on the genus was attempted. Hon. Ellwood Cooper, of Santa Barbara, was the pioneer in this line. Within the last 30 or 35 years Eucalypts have flourished and spread so rapidly that they are now one of the most common of our California trees.

The wood is used variously in this country. While growing the trees serve as a forest cover to mountains, hills, plains and swamps, and as wind-breaks. In this latter capacity they are very popular in the southern part of this State, serving as a protection to groves of orange and lemon trees. They are also the source of many gums and resins and of honey. When cut they furnish excellent fuel and yield an oil, said to possess valuable medicinal qualities.

The rapidity of their growth, enabling them to reach the stature of trees in a very few years, has been the principal cause of the popularity of the Eucalypts. It is this quality which makes them particularly valuable for wind-breaks and for fuel.

Most species, if pruned or if cut off at the ground, sprout freely, sending up shoots which usually make a very vigorous growth. This makes it possible to cut the trees for fuel or timber and in a comparatively short time to have again a forest containing as much timber as before the trees were cut. A Blue Gum (Eucalyptus globulus), 8 to 10 years old, if cut to the ground, will send up shoots which will reach a height of 75 or 100 feet in from 6 to 8 years. Several other species make an almost equally rapid growth after being cut. The cutting may be repeated every few years for an indefinite period. If the wood is to be used for timber purposes it is well to allow it to reach maturity before cutting, since recent tests, forming the basis of this article, show that strength increases very rapidly with its age.

It has been only within the last few years that the value of the wood for timber has begun to be recognized in this country. In Australia it is used almost exclusively as a hard wood for such purposes as tool handles, carriage stock, street paving, etc. Blocks of Karri (Eucalyptus diversicolor), are laid as an improved pavement in the streets of Australian cities. These blocks are placed on end upon a firm foundation and the interstices filled with hot asphalt, mixed with gravel, etc. The surface thus formed is very durable and shows excellent wearing qualities. Many of the species have proven valuable for structural purposes, such as bridge timbers, piles, etc. The major portion of the hardwood lumber exported from Australia is Eucalyptus.

In America the Eucalypts have not yet been grown long enough nor extensively enough to have a source of lumber. The principal uses made of the timber thus far are for fuel, piles, posts and some of the parts of farming implements and for insulator pins on high-tension transmission lines. Eucalyptus globulus has found favor as pile material along the coast. It is extremely durable and is said to resist the attacks of the marine animals. Mr. Cooper, of Santa Barbara, has sold from his groves nearly $10,000 worth of piles in the last ten years.

As an evidence of the growing popularity of Eucalyptus timber for structural purposes the recent action of the Santa Fe Railroad may be mentioned. This road, acting upon the advice of Mr. E. O. Faulkner, manager of the Tie and Timber Department, has purchased 9,000 acres in San Diego county, which it is planting in various varieties of Eucalyptus. Mr. Faulkner was persuaded to this action largely on the basis of a progress report recently rendered the Forest Service by Mr. L. E. Hunt, Engineer in Timber Testing.

In a paper read in 1904 before the El Cajon Farmers' Institute, L. H. Dodson, who has made a thorough study of Eucalyptus, said:

"Land along hollows, too rough to plow, ground covered with bowlders, but which has a deep soil, a thousand places could be found that will just suit Eucalyptus. For the best results the trees should be planted much closer together than they are expected to stand when large. In this way they shade the ground, protect the roots from the heat, cover the ground with leaf mulch, and keep out the dry, hot winds which are so trying on young forests. As the trees grow they may be thinned, though care should be taken not to let in too much sun. At four or five years of age trees taken out are often worth a great deal as fence posts, or even sometimes for more important uses. By the end of ten years there ought to be a good many trees ready for railroad ties or posts, and there will still be a considerable number to grow for lumber if you care to wait for it.

"Just how long it will take to raise a saw log depends on many things. Mr. Gillespie, of San Jose, had a Blue Gum tree cut which made $8.75 worth of lumber, besides three cords of wood. As to the age of the tree I cannot say, but Mr. Lieb, of San Jose, sold a tree 30 years old which measured about five feet in diameter and made 6,000 feet of lumber, beside the firewood gotten from the top. It is not by any means necessary to wait until the tree is five feet in diameter before cutting it into lumber. It is common to see a tree 12 or 14 years old which would make a very respectable log, and I have known of Eucalyptus being sawed at ten years old. Near Los Angeles it seems to be generally understood that from five to seven years is about time to wait before cutting for firewood."

Under favorable circumstances the Blue Gum makes the most rapid growth, but it does not endure the frost well and it is too much of a lowland tree to be expected to stand the dry hillsides without irrigation. The wood is valuable for many purposes, but it will not last long under ground, so it is a poor tree for fence posts, although it makes good piles in salt water, owing to the fact that the toredo will not eat it.

The Sugar Gum (E. corynocalyx) it not as rapid a grower as the Blue Gum in moist land, but will often outstrip it in dry situations. It will stand more heat and a great deal more drought than the Blue Gum. It makes excellent fence posts, as it endures very well under ground. It is one of the strongest of the Eucalpyts as regards mechanical properties, and is too valuable as a hardwood timber to use as fence posts where there are facilities for sawing it.

The E. rostrata grows rather faster than the Sugar Gum and will stand several degrees more cold than either of the preceding species. It will almost equal the Sugar Gum in resisting drought and will stand considerable alkali. It is a very lasting timber under ground, makes a better quality of fuel than the Blue Gum and is considered by many to be better for piles. It does not show as great strength, however, in laboratory tests, and is probably not as good for structural purposes.

The E. diversicolor, or Karri, is a tree to be planted in good bottom land. It is not able to withstand drought, but will endure frosts. It makes a straight-grained timber and

*Reprinted from "California Journal of Technology."

is of excellent quality, being even stronger than the Blue Gum. It is also one of the best honey trees.

Trade Bulletin No. 8, issued by the Bureau of Forestry, discusses the value of Eucalyptus when used as timber. It says:

"The wood of the Eucalypts has not been extensively used by manufacturers in the United States, because the supply has not been sufficient to establish a market. Blue Gum, the most common species in California, has, however, competed with Black Locust for insular pins, has given satisfactory service as chisel and hammer handles, and has been used

SHOWING THE FIBROUS CHARACTER OF EUCALYPTUS GLOBULUS
THE SPLITTING OF THESE LOGS WAS ACCOMPLISHED
WITH MUCH DIFFICULTY

locally for wagon tongues, axles, shafts, spokes, hubs and felloes. It is hard, strong and tough.

"Blue Gum is by far the fastest growing species. The were taken is given in the following table. All the trees were about 15 years old. The Eucalyptus globulus, had, however, grown under more favorable conditions than the other trees:

Common Name.	Species Botanical Name.	Diam. in Inches.	Ht. in Feet.
Blue gum	Eucalyptus globulus	30	101
Sugar gum	Eucalyptus corynocalyx	15	73
Karri	Eucalyptus diversicolor	16	72
Manna gum	Eucalyptus viminalis	12	60
Red gum	Eucalyptus rostrata	9	47
Leather-jacket	Eucalyptus punctata	10	43
Red Mahogany	Eucalyptus resinifera	8	38

"An important point in considering the value of the commercial planting of Eucalypts is brought out in the following table, which shows that the fastest growing are also the strongest:

SPECIES	Age in Years	Bending. Number of Tests	Bending. Mod. Rupture lbs. per sq. in.	Compression parallel to grain. Number of Tests	Compression parallel to grain. Crush Strength lbs. per sq. in.
Sugar gum	15	5	25,344	11	11,290
Blue gum	30	12	23,265	15	12,310
Leath.-j'ck't	15	3	19,267	10	10,908
Karri	15	8	18,386	17	8,795
Blue gum	15	28	16,900	34	8,190
Red Mahog.	15	4	14,550	2	7,920
Red gum	15	9	13,093	20	7,309
Manna gum	15	12	14,380	6	7,723

"A comparison with Forest Service tests on hickory shows that 30-year-old gum is stronger than XXX hickory, and that 15-year-old sugar gum is nearly as strong as black hickory, and 91 per cent. as strong as second-growth hickory.

"The wood of the very young and sappy trees is apt to warp, but that from more mature growth can be easily handled to prevent warping. Early seasoning should proceed slowly. Open piling is desirable. The stacks should be high to secure weight, and should be covered."

A few figures will probably be interesting, showing the immense profits that may be made out of Eucalyptus planting when done commercially. It is recommended by those familiar with the species that the trees when first planted be placed four feet centers. This will allow approximately 2,600 trees to be planted to the acre of ground. In the drouth of about ten years ago it was noticed that the trees where close together produced quicker cover and withstood the dry seasons better than their neighbors, placed farther apart. After about six years, however, they will begin to crowd each other and three-quarters of them may be cut for fuel. According to practice, the average Blue Gum or other fast-growing tree will furnish one-quarter cord of wood at the age of six years. This means about 480 cords of firewood from the trees cut, and there are still left 650 trees to be grown for timber on that one acre of ground. At the end of fifteen years the table above from the Forest Service Trade Bulletin shows the average diameter at the butt to be, say, 12 inches, and the average height to be in the neighborhood of 80 feet. This means that there will be about 150 feet of timber in the tree, of which, allowing for shrinkage, etc., only 100 are available for lumber. In a more mature tree a higher percentage might have been assumed. This value is believed to be on the conservative side. 650x100 gives 65,000 feet of lumber, which may reasonably be expected from one acre at the end of fifteen years. The prevailing prices of Eucalyptus lumber vary slightly, but may be taken as $100.00 per thousand when sawed and seasoned. Logging, sawing, seasoning and marketing would cost in the neighborhood of $50.00 a thousand, depending, of course, upon the accessibility of the grove, etc., leaving a profit net of $50.00 per thousand. 65 x $50 gives $3,250 net, as the value of the lumber on one acre at the end of fifteen years. From the 15-year-old trees the slabs and tops it is estimated would make 300 to 400 cords of fuel, from which a profit of $3.00 per cord could be expected. This, together with the fuel obtained at the end of six years would total a profit of $2,000 for the fuel alone. Adding this to the profit obtained from the lumber, the owner would realize $5,250 on one acre of land in fifteen years. This sum seems large when it is remembered that the land upon which Eucalyptus will grow readily is often not of the greatest value for other purposes. A prospective planter must not, however, fall into the fallacy of buying poor land. A small increase in the original investment, if it secures better land, is wise. The trees will grow faster, producing a large yield of good timber, which will more than repay the additional cost. Under any circumstances the initial cost is comparatively small alongside of the returns which may with reason be expected. The prevailing price for a tree on the stump at the age of fifteen years is about $3.00, which is based upon the value of the wood for fuel. At this rate the 650 trees would be

worth $1,950 standing at the end of fifteen years, and the grower would be relieved of the bother of cutting and disposing of the timber. All this, of course, is in addition to the money realized from the firewood at the end of six years.

If the owner felt that he could afford to allow his money to be tied up for thirty years it would pay him to allow the trees to stand for that length of time. The wood would then have increased nearly 50 per cent. in strength, as recent tests show, and would be more valuable in every way. A greater proportion of the tree would be available for timber purposes. A conservative estimate would place the average diameter of the butt at 20 inches. Cases have been known where a diameter of 60 inches was reached in thirty years, but this is very rare. Assuming, then, a diameter of 20 inches, the B. M. to be expected would be, approximately, 540 feet. 540 x 650 gives 351,000 feet in the acre. At $50.00 per thousand net, this would realize about $17,550 per acre for thirty years. This shows an even greater yearly profit than would be realized by cutting every fifteen years, but, of course, does not give as quick returns for the money. These figures are not claimed to be accurate, but merely show the order of magnitude of the profits to be made.

An outside estimate of cost, including purchase of land, of young trees, preparing ground, planting, care-taking for fifteen years, insurance and interest on invested money, places the sum at $250.00 per acre. This is a very small outlay compared with the possible returns.

Two years ago, so far as is known to the writer, no consistent series of tests had ever been made to determine the mechanical properties of Eucalypts grown in this country. The first work to be done along this line was undertaken by Mr. E. L. Soule and Mr. Thomas Williamson. The results of the ninety-five tests made by them were submitted as a thesis at the University of California. The timber tested by them was all Eucalyptus globulus, having been obtained from two trees, approximately thirty years old, cut on the site of the Greek Amphitheater. The exact age of the trees is uncertain, as no record of the date of planting had been kept. It is impossible to determine the age of an Eucalyptus accurately by counting the annual rings, as is usually done. The growth of the tree is so rapid and of such a nature that there is no clearly defined difference between the Spring and Summer wood. An observer, unfamiliar with this genus, would be liable to err in this matter, as the cross section shows rings of different color. However, there is apparently no direct relationship between these rings and the years of growth.

This wood was seasoned in the logs, under cover, for approximately fifteen months and tested in the Spring of 1904. Mechanical tests were made on 4x4-inch pieces in cross bending, compression parallel to and at right angles to the fiber and shear. Determinations were also made to ascertain the per cent. of moisture in the specimens at the time of test.

A table showing the results obtained follows:

(Modulus of Rupture, stresses and shears given in pounds per square inch. Modulus of Elasticity in 1,000 pounds per square inch.)

Flexure—19 Tests.

	Average	Maximum	Minimum
Breadth of Beam...	3.84"	5.20"	2.97"
Height of Beam....	4.60	5.75	3.76
Length of Beam....	52.20	76.00	46.00
Fiber Stress at Elastic Limit	8610.	10300.	6550.
Modulus of Rupture . . ..13880.		15600.	12270.
Modulus of Elasticity (1000 lbs).....	2827.	3456.	2210.
Modulus of Elastic Resilience (lbs)...	1.52	2.27	0.80
Moisture, per cent....	43.8	53.5	36.4
Rings, per inch.....	2.8	3.7	1.8
Specific Gravity—at test	0.99	1.08	0.91

Compression Parallel to Fiber—19 Tests

	Average	Maximum	Minimum
Fiber Stress at Elastic Limit	4470.	5540.	2670.
Fiber Stress at Rupture	5900.	6850.	3275.
Modulus of Elasticity	1444.	1731.	770.
Moisture, per cent...	40.6	49.6	32.3

Compression at Right Angles to Fiber—19 Tests.

Fiber Stress at Elastic Limit	1368.	1679.	964.
Moisture, per cent...	43.4	49.6	36.4

Shearing—19 Tests Radial—19 Tests Tangential.

Radial Shear	1503.	1865.	1221.
Tangential Shear	1995.	2522.	1568.
Moisture, per cent. Radial	40.4	51.5	28.2
Moisture, per cent. Tangential	40.9	56.3	28.2

During the past fifteen months extensive mechanical tests have been made on Eucalypts by the United States Forest Service at the Civil Engineering Laboratory of the University of California. These have been under the direction of Mr. L. E. Hunt, engineer of tests. The funds for carrying on the work have been provided under a co-operative agreement between the U. S. Forest Service and the State of California. At present over 2,000 tests have been made on this wood. Most of the specimens have been small, 4x4-inch or 2-feet x 2-inch in cross section. A general summary of the results has been given in the extract from the Forest Service Trade Bulletin, quoted above. More detailed results, showing quantitative effects of various factors, such as seasoning, etc., will soon be published in pamphlet form at Washington, D. C.

Bibliography.

The following is a reference list of the principal works which have been written on the genus Eucalyptus, many of which have been used freely in the preparation of this article.

American.

Bulletin No. 35, Forest Service, "Eucalypts Cultivated in the United States," by A. J. McClatchie.

Trade Bulletin No. 8, Forest Service.

Forest Culture and Australian Gum Trees, by Hon. Ellwood Cooper.

Eucalypts from the Esthetic, Botanical and Utilitarian Standpoints, by Hon. Abbot Kinney. Published by Baumgardt & Co., Los Angeles, Cal.

Prof. L. H. Bailey's Cyclopedia of American Horticulture, Vol. II. Article on Eucalyptus, by Mr. J. Burt Davy, formerly of University of California.

Foreign.

Baron von Mueller's Eucalyptographia, published by the Government Printer, Melbourne, Australia. Very complete and good.

By Rev. Wm. Woolls, of New South Wales, "The Genus Eucalyptus" and "The Plants of New South Wales."

Various Bulletins, Papers, etc., by Joseph Maiden, Director of the Botanical Gardens at Sydney. These treat of Eucalypts as timber trees in Australia and are exceedingly valuable.

Les Eucalyptus, by Felix Sahut, of Montpelier.

Eucalypts Introduced Into the Mediterranean Region and Description and Use of Eucalypts Introduced Into Europe, by Chas. Naudin, Director of the Botanical Laboratory at Villa Thuret, Antibes.

Agriculture Gazette of New South Wales, 1893-1901.

FIRES CAUSED BY ELECTRICITY AND GAS.

In his address at the last meeting of the Berlin District Gas Association, Herr Schaefer, of Dessau, remarked that statistics furnished by German insurance companies did not confirm the thought that fire risks had been diminished by substituting electric for gas lighting.

In 1883 the electricians were in high hopes that the "alleged immunity from fire risk" of electric lighting would enable them to get reduced rates from the insurance companies. Such reduction of rates was often spoken of, but never came to pass. In 1896 the Hanover Fire Insurance Company told their shareholders that the question of the comparative safety of electric lighting was by no means settled, but that clearly there could be no reduction of rates. In 1898 the German Association of Fire Insurance Companies memorialized the Imperial Chancellor, requesting him to put electrical installations under police control and supervision; and a year after they remarked on the considerable increase in the number of fires due to electricity. In 1901 the Dessau Gas Company inquired whether they could get reduced rates on replacing gas by electricity, and were told that under no circumstances could there be a reduction, but that there might be an increase unless the installation was put up and maintained according to the regulations of the Fire Insurance Association.

In Germany there are two groups of insurance companies—18 private companies and 36 public associations. Both of these groups have published some statistics. Those of the former group appeared in Neumann's "Vereinsblatt fur Deutsches Versicherungswesen"; those of the latter group in the year book of the "Mitteilungen fur die offentlichen Feuerversicherungsanstalten." The author has summarized these statistics in diagrams, which show that the fires caused by gas and electricity fall far below those due to explosion of spirit or petroleum, or to children playing with matches. In 1899 and 1900, children with matches caused 1,125 and 963 fires in the purview of the 18 private companies; explosions of mineral oil caused 1,583 and 1,627; electric failures caused 204 and 226; explosions of spirit (alcohol), 207 and 207; and gas explosions 158 and 199. Under gas explosions are reckoned acetylene, producer gas, oil gas and the like, as well as coal gas.

Unfortunately, these statistics of the 18 private companies were not continued in this form beyond the year 1900. The fires due to electrical causes in the years 1901-4 amounted, however, to 265, 238, 248 and 278 absolutely almost constant; but relatively to the increase in electric lighting, these figures show a diminution. In 1903 there were 98, in 194 there were 208 fires due to explosions of alcohol—an enormous number, having regard to the small extent to which spirit has come into use. Petroleum lamps, matches, and the children who play with them, seem more in need of police supervision than electric installations do.

As to the 36 public insurance associations the results are much the same. Their data show the following:

	1897.	1898.	1899.	1900.	1901.
Total number of fires....	16,950	17,133	18,947	18,316	19,941
Whereof caused by—					
Children and matches..	967	1,012	1,128	1,080	959
Petroleum explosions..	367	362	414	354	415
Gas explosions	67	68	65	57	87
Electricity	22	25	51	42	73

During the 5 years, 5.64 per cent. of all the fires were occasioned by children playing with matches, 2.09 by petroleum explosions, 0.38 per cent. by gas explosions, 0.23 by electricity. The number of fires due to electricity increased much more rapidly, in comparison with those due to gas, than the relative expansions of electric and gas lighting would indicate. Here, also, "gas" included acetylene, etc., as well as coal gas. It is worthy of note that both gas and electricity were responsible for a relatively small number of fires.

The statistics of the Berlin fire department show that the number of fires have by no means kept pace with the expansion of the two systems; that out of every 900 electric services there is one fire per annum, while with gas there is only one fire per 8,000 services. In Berlin last year (1904-5) there were 12,788 fires, of which 30 were due to gas, 25 to electricity, 77 to children, 18 to petroleum.

During the 5 years, 1900-1 to 1904-5, there were 9 fires in electric works in Berlin; 1 in a gas works; 29 fires in electric works all over Germany. During the same period there were 66 fires in Berlin theaters, of which 21 were due to electricity; once to four times in almost every Berlin theater; and it was only the continuous supervision which prevented these becoming dangerous. During the same period 32 shops were set on fire by electricity.

NATIONAL BOARD OF FIRE UNDERWRITERS' QUARTERLY REPORT.

The Electrical Bureau of the National Board of Fire Underwriters have issued their quarterly Fire Report for quarter ending January 1st, 1907.

While electric equipment, if properly installed by responsible parties, offers no greater hazard to property than other systems of lighting and power purposes, a lax observance of the necessary precautions and specifications of the National Electrical Code, does materially increase the danger from fire, as shown by several reports of electrical fires, as taken from the above-mentioned report.

Circuits Overloaded.—Fire originated from a short circuit above a metal ceiling and spread through the open partition into the attic above. The original electric installation in this building was good, but trouble was caused by overloading the circuits. The 16 candle power lamps for which the circuits were planned were replaced by 140 candle power lights. The branch circuits were fused to 30 amperes and the service cut-out was fused with strips of lead wire No. 3 B. & S. gauge. $8,000 damage.

Ground on Gas Pipe.—Wires leading from basement through a partition wall to side bracket worked loose and end of wire came in contact with unused gas pipe, causing flash sufficient to ignite insulation of wire. Flames spead in partition until fire was beyond control. Installation about fifteen years old and recently replaced in part by new work. Damage, $10,000.

Incandescent Lamp Starts a Fire.—A window dresser was called away from his work and left a lighted 32 candle power lamp resting against a wax figure in the show window. The lamp did not have a wire guard. Heat from lamp set fire to figure. Loss, $1,500.

Untaped Joints in Wooden Moulding.—A fire was started by a short circuit in wood moulding carrying branch lighting circuit, caused by water leaking through from floor above. Taps for drop cord where short occurred were not soldered or taped. Damage slight.

No Emergency Switch in Line.—Engineer in large station supplying current to several synchronous motors in a cotton mill cut off power for a few minutes and then without warning put it on again. Motors dropped speed and were caught out of phase when circuit was made alive again. The result was the burning out of several armature coils. The attendant noticed trouble and opened the disconnecting switch to save the motors. Short circuit took place across the switch and the heat became so intense that the attendant was driven out of the room. There were no emergency switches in the line and it was ten minutes before the power station could be notified to cut off the power again In the meantime the switchboard, consisting of several panels, and the contents of the room were destroyed. Loss $5,028.

Tacks Make Short Circuit.—In the parlor of a hotel having a direct current isolated plant there were two arc lamps temporarily hung, and the connection to same was made by heavy cotton covered wires hidden on top of a picture moulding. Preparatory to a political meeting the

decorator tacked bunting, etc., to the moulding and evidently the tacks penetrated wire coverings, causing a short circuit when current was turned on. Damage $50.

Jumped His Fuses.—Electrician in charge of a large plant had orders to keep the lights going at all hazards. The main cut-outs were in a wood cabinet hung to a heavy wood post in center of a large room three feet under the wood roof. The main leads were open and strung on roof beams, and carried 110 volt alternating current circuit. The load was too great for the installation. One fuse blew and started fire and burned off service wire of fuse terminal. Afterwards, not being able to hold his fuses, the electrician put jumpers over them, but did not attempt to make good joints. One jumper was made up of 2 "0000" cables taped but not soldered. The other jumper was a single cable like the first, joints bare and unsoldered. The heat developed again set fire to the cabinet which was lined with two thicknesses of ⅛-inch asbestos. Loss confined to cabinet.

Unused Service Wires not Cut Off.—A broken cleat allowed one wire of unused service system, which had not been cut off outside of building to come in contact with woodwork which was water-soaked. Ground through the wet wood to water pipe, set fire to insulation and wood and also made the water pipes alive, resulting in serious injuries from shocks to several inmates of the house. Prompt discovery prevented large fire loss.

Another Flat Iron Fire.—Current was left on in an electric smoothing iron in a large tailoring establishment. The iron stand became so hot that it charred the wooden table on which it was resting, causing considerable smoke, which drew the proprietor's attention thereto. Damage slight.

Ground on Gas Meter.—Fire was caused in a large furniture store by an employe of the light and power company in testing a meter. He crossed the knife blades on service switch with small tool, bringing the tool in contact with a gas meter which was located too near switch. The arc burned a hole in the meter and set fire to the escaping gas. The fire communicated to paper and canvas ceiling. Loss, $100.

Defective Car Heater Causes Large Loss.—Heat was turned on in a car stored at the terminal of elevated road. The car was equipped with old style heaters. The heaters failed by wires of the heater coils breaking. Arc set fire to woodwork of car. Fire spread and eight cars were damaged. Loss, $10,000.

Ground on Metal Lathing.—Wires feeding a bracket fixture in a room of a large hotel ran up behind expanded metal lathing on the wall. Wires were not properly insulated and burned an arc between wall and metal until it burned through the plaster and drapery. But for the fact that the burn-out occurred on a brick wall and in the day time, serious loss would have resulted.

Defective Arc Lamp.—Carbon holders in arc lamp failed to work. Coils in lamp became overheated, setting fire to insulation of wire. Fire communicated to wood ceiling. Loss, $15.00.

Tailors' Flat Iron.—Tailoring flat iron left turned on all night in a six-story department store. Iron was resting on an all iron stand. Indicating switch and lamp in multiple were installed. The heat from the iron communicated to the stand, which in time became so hot as to ignite dry goods on table on which the iron stood. Fire also traveled along circuit wires. Automatic sprinkler system operated and put out fire. Loss, $2,000.

Summary of Reports Received During the Quarter.

Sixteen fires have been reported as caused by high tension lines falling across telephone and lighting circuits. Losses given amount to $966.

Grounding of lighting and motor circuits have been responsible for eighteen fires. Losses as reported, $11,240.

Short circuits of interior wiring caused thirty fires. Losses aggregate $19,500.

Moving picture machines, five fires, $1,400.

Electric motors, twelve fires, $5,540.

Fuses blowing caused six fires.

Electric flat irons, four fires, $7,698.

Lightning, nine fires, $3,328.

Car heaters, three fires, losses, $11,000.

Incandescent and arc lamps have been responsible for nine fires. Losses as given, $1,535.

Three tree fires are reported.

Eighteen accidents to persons are reported, two of these being fatal.

All of the fires summarized above have been reported to this bureau by inspectors.

The losses so reported aggregate $62,207, but it should not be assumed that these figures represent the entire fire loss due to electrical causes.

In addition, fifty-three accounts of supposed electrical fires have been received, in which the causes were given as "crossed wires," "defective wiring," etc. Of these fires no more definite information has been obtainable. The aggregate loss on these fires was $572,603.

Fifteen other fires at first reported as due to electricity, upon further reliable investigation by inspectors, have been found due to other causes. The losses on these fires amount to $112,200.

RUBBER.

One of the most important questions demanding the attention of the electrical engineer at the present time is that concerning the supply of india rubber, or caoutchouc. For while the demand for this material has been steady, the supply has at times proved inadequate, owing to various causes, hence the interest with which the cultivation and production of rubber is regarded. Happily ,there is little or no reason to fear a scarcity of supply in the near future, judging from the satisfactory reports that reach us from various producing centres. According to a report sent by Mr. D. F. Wilber, the American Consul-General at Singapore, to the Washington Bureau of Manufactures, there is a great boom in the planting of rubber throughout the Malay Peninsula, in the Federated Malay States, and Johore. It has proved a lucrative business in many instances for promotors, who have floated company after company until at the present time there are eighteen rubber companies owning plantations in the above countries, most of them being organized during 1904, 1905 and 1906. In the native States of Selangor, Negri, Sembilan, and Perak, out of a total of 134,664 acres, 21,266 are now in rubber. It is estimated that a return of at least half a pound per tree could be secured from five-year-old trees, but calculations are not made on anything until the sixth year, when it is certain that rubber planted on good alluvial land will yield at least one pound per tree. Several millions of Para rubber trees have been planted in the Federated Malay States during the past five years,and experimental tapping of these older trees has proved satisfactory. As much as twelve pounds of rubber has been extracted in two years from a tree thirteen years old in the Penang gardens without any injury resulting, although the soil in that particular place is not considered favorable for rubber planting. There is quite an amount of the lower-grade rubber produced in this section, but planters are now paying more attention to the better grades, and the next few years will show a large increase in the output of Para rubber. The Malay Peninsula seems to be an extremely fertile field for the production of rubber, for it has been estimated that within the next seven years the total exports of cultivated indiarubber from Ceylon and the Federated Malay States will reach between ten and fifteen million pounds annually, and that after fifteen years they may exceed the exports of the so-called wild rubber from Brazil.

ANNUAL PRODUCTION OF OIL AND WATER GAS.

Returns were received from 477 oil and water-gas producing companies, and these show that the total production of water gas in 1905 was 82,959,228,504 cubic ft. Of this quantity 5,547,203,913 cubic feet, or 6.7 per cent., were lost by leakage, etc., leaving 77,412,024,591 cubic feet as the net production obtained and sold. As the quantity of gas made and sold at coal-gas and by-product coke-oven works was 40,454,215,132 cubic feet, it appears that the consumption of water gas and gas made from crude oil was nearly twice as much as that made from coal. It also appears that while the average price of coal gas in 1905 was 81.4 cents per 1,000 cubic feet, that of oil and water-gas combined was a fraction of a cent in excess of $1.00 per 1,000 cubic feet. Still further comparison shows that whereas 66 per cent. of the production of coal gas was sold as illuminating gas, 77 per cent. of the combined production of oil and water-gas was used for this purpose.

GREATEST POWER HOUSE EVER BUILT.

Final contracts have been awarded and ground is about to be broken for the construction of the remaining half of the Brooklyn Rapid Transit's Williamsburg power station. The dimensions of the new half will be about 200 by 130 feet, and, like its forerunner it will rise to the full height of a ten-story building. Together with the half already completed and now in partial use the new addition will complete the company's plans and make a power station far larger than any ever before conceived or constructed, rising to a great height above narrow Kent avenue, and covering a tract 200 by 260 feet and costing the enormous sum of $5,500,000.

The new power house adjoins the south wall of the old eastern station, built by the Brooklyn City Railroad but a few years ago, equipped with Corliss engines—now almost an obsolete type—and regarded as about the finest type of power house construction possible. Today it is but a toy compared with its big new neighbor, equipped with modern turbine engines of tremendous horsepower and burning more than 2,000 tons of coal every twenty-four hours to keep the engines going. The two power houses—old and new—occupy a frontage of 373 feet on Kent avenue and extend back to the East River, which gives unexcelled water transportation for fuel and for ashes.

The first half of the Williamsburg station was built on the Kent avenue side of the property. The second half will be built to the west and close up to the company's dockage. The temporary west wall of the present structure will be torn out and the great engine-room, extending clear from floor to roof, will be doubled in size. Similarly the two boiler rooms, the one imposed above the other, will be increased in dimensions and thirty-six new boilers of the improved water-tube type will be added to the thirty-six similar boilers already in service. Nearly a week's supply of coal can be kept in the great bunkers of the attic, which will be increased in ratio with the rest of the structure.

The interior of the Williamsburg power station has been a marvel to those privileged to see it. The old idea of any structure devoted to the mere housing of machinery has been reversed by the B. R. T., which believes that in giving Brooklyn the world's largest and finest power station, details should be in keeping with the rest of the project. So details have not been neglected. Bronze clustre lamps adorn the ornate entrance to the power station on Kent avenue, the entire facade has been made an attractive architectural conception in limestone and fancy brick, the entrance ways are tiled and walled in marble, while the interior of the engine room, the largest single room in the city, has been made radiant by the use of white porcelain lining brick with a plentitude of decoration in colored tile and terra-cotta. Illumination is furnished by bronze bracket lights and long strings of incandescent lamps fastened to the roof girders.

Four new turbines, each of 15,000 horsepower, have been ordered for the new part of the power station, and already are under construction in the Pittsburg shops of the Westinghouse company. They are the largest steam engines or electrical generators ever built, and like the big power house itself, mark a new standard and a new era in electric railroad construction. They will be an extensive addition to the engine equipment of the present half, which comprises four 10,000 horsepower turbo units and one 7,500 horsepower turbine. Three of these are already in effective service, while the fourth goes into operation within a very few weeks.

The Williamsburg power station will easily develop 100,000 horsepower, which can be increased under pressure and with little trouble to 150,000 horsepower. The immensity of such power can be better realized when it is fully understood that on its heaviest days the demands on the power houses by the whole B. R. T. system—surface and elevated—does not exceed 120,000 horsepower. It can readily be seen that the new power house makes ample provision for future growth of the system, and that in case of the almost impossible—the complete breakdown of all the power stations of the system—Third street, Eastern, etc.—the Williamsburg giant could move the 3,000 cars of the B. R. T. with scarce an effort.

Work is to be pushed with all possible speed toward completing the new station, and it is anticipated by the company that twelve months will see its nine great units being operated and the new power house being tested to its highest efficiency.

ANNOUNCEMENT OF CIVIL SERVICE COMMISSION EXAMINATIONS.

Irrigation manager in the office of Experiment Stations, Department of Agriculture, salaries of $1,800 to $2,500 per annum. Second-class or Assistant Steam Engineer in Courthouse and Post Office building, Salt Lake City, Utah, salary, $900 per annum. Assistant Assayer in the United States Assay Office at Charlotte, N. C., salary $1,250 per annum. Irrigation Farmer in the office of Experiment Stations, Department of Agriculture, at salaries of $720-$1,200 per annum. Supervising Drainage Engineer in the office of Experiment Stations, Department of Agriculture at salaries of $2,000-$2,500 per annum. One draftsman, San Francisco, Cal., $1,400 per annum. One draftsman, San Francisco, Cal., $4.00 per diem. Two copyist-draftsman, Phoenix, Ariz., $4.00 per diem each. One draftsman and three copyist-draftsman, Reno, Nev., $4.00 per diem each. One draftsman, Bismark, N. Dak., $1,400 per annum.

SAN FRANCISCO WATER SUPPLY.

The Supervisors of San Francisco have adopted a resolution calling on City Engineer Woodward and his former assistant, John R. Price, to continue their investigation of the water supply proposed to be furnished the city by the Bay Cities Water Co. from the American and Cosumnes rivers, the initial cost of which is to be $10,500,000. The two investigators are expressly directed to go to the Bay Cities Water Co. for data. The resolution bids the engineers "demand of the proponents of the American-Cosumnes Water Supply Co. the production for their use in the preparation of their report of all engineering data, surveys, etc., in their possession," bearing on the matter in hand. From this data the engineers are requested to inform the Board if the city could be assured of a continuous and immediate supply of 75,000,000 gallons daily, also as to the horsepower capable of being developed, the character of the existing works and the possibilities of future development of the system. The resolution ends as follows: "The object of the Board is to determine whether or not the supply offered meets the requirements of the city for a municipal water supply, and if it be so found, then the Board will investigate and determine upon the question of titles and of the price of said supply; and if the adequacy of said supply, and the titles thereto, and the price thereof shall be found satisfactory, then the Board will submit to the people of the city, at the earliest practicable time, the proposition for a municipal water supply."

The JOURNAL of ELECTRICITY POWER AND GAS

Published Weekly by

THE TECHNICAL PUBLISHING COMPANY

SUCCESSORS TO

The Journal of Electricity Publishing Company

304 Atlas Building, San Francisco.

Yearly subscription, $2.50. Single copies, 10 cts. Back numbers prior to the current month, 25 cts. Foreign subscription, $4.00. Subscriptions cannot be begun with back numbers. Manuscripts submitted must be accompanied by postage to insure return.

Address all communications and make all remittances payable to The Technical Publishing Company.

EASTERN AGENCIES

NEW YORK .....
CHICAGO .....
ST. LOUIS .....

WESTERN AGENCIES

LOS ANGELES .....
PORTLAND .....
SEATTLE .....

Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," with which is incorporated "The Engineers', Architects' and Builders' News."
Entered as second-class matter at the San Francisco Post Office, August 15, 1899.
Entered as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895.

VOL. XVIII FEB. 9, 1907 No. 6

EDITORIAL.

The Builder and the Contractor

The greatest single piece of construction work of modern times is the digging of the Panama Canal. The builder, the United States Government, has resources probably as large as any builder in the world. The work involves all features usually found in such enterprises, including financial, labor, sanitary, and commissary matters. The federal government has done in the past, and is at the present time doing under the direction of its numerous departments, many kinds of construction work without the use of a general contractor, the supervision and labor being furnished solely and paid directly by the government. Notwithstanding this fact, the Panama Canal is to be built by contract under the plan generally known as the percentage basis, wherein the contractor is paid a certain fixed fraction of the total cost of the entire work, to which may be added additional amounts or bonuses, depending upon the saving in time and money resulting from the efforts and ability of the contractor in reducing the period of time required for the actual construction and the actual total cost of the work to the builder.

The decision of the government to have all the work done by contract has received the unqualified approval of the men, both engineers and laymen, who from their knowledge and experience are best fitted to express an opinion in the matter. It must be said with regret that politics, not good politics, but bad—yes the worst politics—has too many times entered into government work of every character. Every American citizen has just cause to be proud of his country, a great many have good reason to respect the government of the State in which they live, and a few—a very few—can honestly say they believe in the honesty and integrity of their city governments. And so, if by letting the contract to build the Panama Canal the federal government can completely and forever prevent unscrupulous politicians from increasing the cost of the work, in order to favor some undeserving rascals, or delay the time of completion in the interests of any class of citizens or corporations, an advance will certainly be made which will be welcomed by every loyal American.

In proceeding with the work as above outlined, the officials at Washington are but following the example set by the most successful private corporations, both large and small. The enormous expenditures required in building and equipping large transportation systems and also electric, gas and power installations, have placed upon those in charge of such work a responsibility not easily defined. And it is a fact that the men are few who have had the experience and training, not mentioning the personality, required to wisely direct such construction work, so that it will be built at minimum cost, consistent with the best workmanship and the smallest amount of time required for the work.

The men who are best fitted to prosecute, direct, and supervise construction work of this magnitude are found today in such a position that their proper remuneration can more readily be provided by a private contracting firm than by the federal government.

TRADE CATALOGUES.

The Joseph Dixon Crucible Co., Jersey City, N. J., have started out the New Year with a bright and cheerful issue of their "Graphite." Although devoted almost entirely to their graphite productions it is full of interesting reading matter.

Kerr Turbine Co., in their Bulletin No. 2, give descriptions of their steam turbine and steam turbine blowers. They also show a number of other applications of the steam turbine to general use.

Requests for this catalogue should be sent to Kerr Turbine Co., Wellesville, New York.

The India Rubber and Gutta Percha Insulating Co. have issued a new price list for Habirshaw wires and cables with addition tables for extra braids, cotton or paper wrapping, Pacific Coast prices, 30 per cent Para compound, flexibles and lead covering.

This pamphlet will be of interest to the trade, as it does away with the necessity of the frequent issue of leaflets giving the varying changes in the price of wire due to the fluctuating copper market. By means of this pamphlet the trade can ascertain the price of wire if they know the market price per pound on copper bars.

The book also contains a synopsis of rules and a comparison of copper wire gauges, etc.

The California Electrical Works are the Pacific Coast Agents for this company.

The Electric Storage Battery Company, of Philadelphia, has recently issued a folder describing the application of "Chloride Accumulators" and "Exide" batteries to stationary gas or gasoline engines. The folder illustrates the system of battery ignition with these cells, both in stationary form, where charging current is available, and in portable form where it is necessary to carry the batteries to a convenient charging source.

Illustrations, dimensions, weights, capacities and prices of the two-plate types of "Chloride Accumulator" and of the "Exide" Sparking Batteries are given with a diagram of connections, and a concise explanation is included showing the method of determining the necessary resistance for cutting down the line voltage from an ordinary lighting circuit.

The folder will be found useful to all operators of stationary engines, and will be forwarded from any of the sales offices of the company, upon request.

The Locke Insulator Mfg. Co. The Insulator Book, 1907 edition.—The splendid finish and arrangement of this catalogue and the value of its contents to the engineering fraternity will, beyond doubt, create a great demand for it.

The compilers state that every endeavor has been made to present only such material and data as has withstood the test of actual service, and great care and conservatism has been used in recommendations.

Several pages are devoted to testing, with illustrations and drawings, explaining methods. A table for sparking distances is also given. Standard designs for pole top construction, together with excellent cuts of the various types of insulators manufactured, complete the sixty pages of the book.

Allis-Chalmers Co., Electrical Department. This Bulletin on the subject of the "H. Ward Leonard System of Multiple Control for Variable Speed Motors," is reprinted from Bulletin No. 1044.

The matter contained therein is of interest throughout, especially that part devoted to a "comparison of variable speed systems." This shows by means of tables and curves the efficiency of the various systems.

(Allis-Chalmers Company). Bulletin No. 1403, entitled "The Hancock Jig" recently reprinted. This company states that their mining department has in its possession considerable data showing the economies effected by the use of this Jig at a large number of ore reduction centers in the United States, Canada and Mexico, extracts from which will be published in a subsequent bulletin. No. 1403, however, contains sufficient matter to indicate the saving which has attended the introduction of the publication, especially at this time. You rae doubtless in already read it will undoubtedly find the publications of value.

OUR FOREIGN LETTER.

Arriving in Berlin yesterday, from a Christmas trip to Italy, was pleased to find the first three copies of your estimable publication on my desk. Am pleased and surprised at the excellence of th epublication, especially at this time. You are doubtless in receipt of more descriptive matter than you can use in relation to these foreign power plants, and as I am not in a position to get detailed descriptions so much as a broad study of them all, and their results, will endeavor to give you the latter.

Would suggest that you keep in touch with the Deutscher paper, "Die Turbinie," as it contains all the latest of this country in steam, gas, and compressor turbines. If you want any German translation done, beg to refer you to a Miss Duden, an employe of the "City of Paris," who reads and writes English and German equally well, and whose rates are very reasonable.

The German technical papers are very fine, but only about twelve in mechanical engineering are worth mentioning. Their books are good and very up to date; it is the practice to issue quite an exhaustive pamphlet for a few cents, on a subject that has only just come before the public. For instance, a new steel is advertised by a firm; in a few weeks you can buy the pamphlet of some professor, who has made a complete analysis of the steel, and knows approximately how it is manufactured.

The great demand for American machine tools here, increases steadily, and the American firms are either very indifferent, or they cannot handle the business, for all the German firms are simply howling for American tools, which they cannot get. Acme automatics and Niles heavy machinery are attracting a lot of attention just now, but every good make is being used.

The fine performance of the turbine steamer "Princess Elizabeth" is attracting considerable attention. She is 347 feet long, has three turbines, three screws, and has been running over a year.

Much data and records of tests is being published on centrifugal pumps; makers now being able to produce a pump that competes commercially with the best types of reciprocating pumps. A very fine paper at the "Vereines Deutscher Ingeneure," by Dr. H. Hoffman, describes the machinery in use in German mines, and mountain work. These mines are, as a rule, splendidly equipped, including the highest types of express pumps; high duty centrifugals, driven by huge slow speed induction motors, direct connected in all cases. There are also shown direct connected electric hoist works, gas engine power stations, steel furnaces, structural steel galleries, bridges, steel ore cars, electric locomotives, steel elevators, and an electric hydraulic pressure plant. The machinery is of a higher class, and greater efficiency than is used in California generally.

A large structural steel mast crane has just been built by a Berlin firm; it is some 140 feet tall, with 75 feet radius, and lifts about five tons at any point within its circle.

The discussion of gyroscopic wheels on ship board, which was in the American papers so much last year, is now being taken up by German authorities, and analyzed, with ponderous equations, and heaps of letters and radicals.

It may please some of our readers to know that rotary engines are invented here with the same continuous regularity, and patented, as in America. Some have myriads of moving parts, others are as naked and simple as Adam.

What at home we call a plain traction, thrashing, or portable engine, over here is portable; but, it is, as made by R. Wolf, cross compound, condensing, with feed water heater, and super heater.

The best type of level used for accurate municipal work, is about the size of a small cannon, and is carried in a carriage, other instruments in proportion.

Paul Heuer, Dresden-A-7, manufactures a reduction speed changer, which he claims will give any ratio between 1-4 to 1-50, and it looks very neat from the outside. One firm has been getting splendid results in efficiency with a centrifugal pump having only three blades.

A great many bucket and chain dredges are being built for harbor work, and river work. They are very large, and with steel hulls, and steam propelling mechanism, and cost as much and more than a well equipped of the same tonnage.

The sterobograph has been attracting a good deal of attention. It is an instrument which indicates and registers the variations, angularly in the rotation of an engine or other shaft. All papers have the usual profound and theoretical articles on various subjects; but in many cases a man could build and try the idea while trying to read one of them. Yours truly,

E. N. PERCY.

UNITED STATES CIVIL SERVICE COMMISSION EXAMINATIONS.

Geogolist, Philippine Service, salary, $2,000 per annum. Apprentice Topographic Draftsman in the Coast and Geodetic Survey, salary, $700 per annum. Civil Engineer Student in the office of Public Roads, Department of Agriculture, salary, $600 per annum.

EXPOSITION OF SAFETY DEVICES AND INDUSTRIAL HYGIENE.

Governor Hughes of New York is a central figure in a new movement that is outside of statesmanship, and yet, in the broader, better sense, is statecraft in a high degree. Sparing the lives of tens of thousands of men and women each year is this new movement's aim. In a great banquet at the Waldorf-Astoria on the evening of January 28th, the famous Chief Executive of the Empire State made the leading speech. His words were the first definite step towards the establishing of an American Museum of Safety.

Several hundred men of prominence attended this dinner—manufacturers, merchants, publicists, society men, capitalists, editors of technical journals. Men who have the handling of men were its guests. The text of the night was a single idea—America's heedless waste of her workingmen, the fact that this country's mechanical triumphs are being overshadowed by the danger to life in the wonderful advance.

The new movement for some sort of security for the American workman as he bends over his machines is on a firm foundation. The day after the Waldorf-Astoria banquet, Chapter II will be opened. In a wing of the huge American Museum of Natural History, New York, through the instrumentality of Morris K. Jessup, president of the New York Chamber of Commerce, an "Exposition of Safety Devices and Industrial Hygiene" will be opened, with exhibits, photographs and models for protecting the lives of working people, gathered in this country and abroad. The exhibit will last two weeks at least, will be free to every one, will keep open Sundays and evenings, and a feature of it will be many illustrated lectures given by Dr. William H. Tolman, director of the American Institute of Social Service, under whose auspices all of this is being done.

57,000 Killed Each Year.

According to the census, 57,513 persons in the United States suffered violent deaths in 1900. Where we have exact figures for comparison they show more than twice as many accidents in this country, relatively, as in Europe. A large proportion of them needlessly and heedlessly, while half a million more were injured.

There, Museums of Security are in active existence, and make known, popularize and force into use devices for guarding machinery.

Even in Russia such a museum exists. A fine Museum of Security has been established in Moscow, and guards the Russian working man. "We talk," says Dr. Strong, "of the barbarities of war, and do well to establish our peace societies. Is it not time to do something to stop the increasing barbarities of peace?"

But what after all, is a "Museum of Security or Safety?" However effective abroad it is a completely new idea for this country, and one that "boss" and workmen, generally speaking, know nothing of. What does a Museum of Security do; how does it stop accidents? Why should the great magnate, Henry Phipps, write recently to the American Institute of Social Service and say:

"I am pleased to learn that you are to have an Exposition of Safety Devices and Industrial Hygiene. It is a matter I have been thinking of a good deal, and I intended writing one of the leading railway presidents in a company in which I have an interest; but your method of going about it is much better, and I am glad to inclose you my check for $500."

In an article in a recent number of the Century Magazine, Dr. Tolman described interestingly just what a "Museum of Security" was, what it had already accomplished abroad:

What Such a Museum Is.

"The idea of a Museum of Security excites curiosity. People ask, 'What's that?' It is not surprising that there should be general ignorance on this subject, because such institutions are of recent origin, the first having been opened in Amsterdam in 1893, in charge of a mechanical engineer, who is responsible for the supervision of machinery and its explanation.

"Among the curious sights in Amsterdam there is one that will escape the tourist unless his attention is particularly directed to it. Leaving the royal palace behind him, cutting through the narrow streets, crossing the numerous bridges of the Venice of the North, and making his way down a side canal, he comes upon the "Museum van Voorwerpen ter Voorkoming van Ongelukken en Ziekten in Fabriken en Werkplaatsen.' Reduced to its lowest terms, this means in English the 'Amsterdam Museum of Security.'

"This building contains a permanent exposition of apparatus and devices for the prevention of accidents in factories and workshops, so that manufacturers and all other employers of labor may see in actual operation the safety devices that guard the lives and limbs of their workers. This museum owed its origin to the Association for the Development of Manual Training and Handwork in Holland. The labor inspectors of Holland find that the museum is of the greatest service to them, because it meets every objection on the part of a superintendent that the safety device in question will interfere with the proper operation of his machinery.

"In 1887 an important exposition of devices for the prevention of accidents to laborers was held in Berlin. An effort to preserve the valuable documents and other exhibits as a collection did not succeed at that time, chiefly through the failure of the government to co-operate. But in 1900 an appropriation of $142,000 was made by the Reichstag for the creation of a museum of security. The Reichstag also appropriated $75,000 in 1901 and $43,750 in 1902. For the maintenance of the museum, which is in Charlottenburg, an appropriation of $7,500 was made in 1902 and $10,000 in 1903.

Importance of Industrial Hygiene.

"As its name indicates, the Museum of Security aims to become a permanent exposition not only of devices for the prevention of accidents to laborers, but of the best suggestions originated by any person or institution to help workmen in any way. It is really divided into two great sections, one comprising all that has to do with the prevention of accidents in the various branches of industry and the other comprising social and industrial hygiene.

"'What was your plan for collecting your machines and models?' I asked Dr. Albrecht, the executive director in Charlottenburg.

"'In the first place,' he said, 'we appealed to constructors and inventors, offering a place in the museum where such methods and devices could be brought to public attention, in this way enlisting the support of all classes. We reserve in support of alP,26,nY shrdcmfwypshrdlcmfwycmfwycmfwyp every instance, however, the right to refuse any specimen or plan not deemed useful. The exhibits are temporary, and at any time may be replaced by others that are better. The museum is already so full that the question of enlarging it has been brought up.'

"How do you guard against the admission of machines or devices that are unsuitable?" I asked him.

"'For that,' replied the doctor, 'we have a jury of twenty-eight experts—engineers, factory inspectors, technicians and of four trade representatives, namely, a brewer, a cabinet maker, a worker in metals and a worker in textiles. Any device that is passed upon by this jury is accepted as a loan by the museum for one year, with the privilege of its renewal. In this way we keep the exhibits thoroughly up to date, replacing old models by those that are new and more highly perfected.'"

Details of the Exhibit.

The coming New York Exposition, opening on the morning of January 29, will consist as much as possible of "live exhibits," that is, machines or devices in operation; models

of acutal or reduced size, and photographs. Wood and metal-working machinery; stamping, grinding and polishing machines;presses; textiles; the building trades; safeguarded elevators, windlasses, cranes and hoisting machinery; transportation security by sea and land; safety lamps and explosives; quarrying, agricultural and chemical industries; safety from fire.

The Section of Industrial Hygiene will include, improved dwellings; first aid to the injured; prevention of tuberculosis and other dread disease harmful to the life of workmen; respirators and devices for supplying and maintaining pure air and industrial betterment.

To each exhibitor a diploma will be presented, designed by one of the foremost artists of America. A handsome medal has been made. Its obverse shows a graceful figure of a woman against a background of machinery, and the legend is "Security for Humanity's Sake." On the reverse is, in panel form, "First International Exposition of Safety Devices and Industrial Hygiene by the American Institute of Social Service."

Carroll D. Wright, now president of Clark University, will represent the President of the United States at the banquet and will speak. "The Institute's honorary vice-presidents for this work are Grover Cleveland, first vice-president; Frank W. Higgins, ex-Governor of New York; Curtis Guild, Jr., Governor of Massachusetts; E. C. Stokes, Governor of New Jersey; Henry Roberts, ex-Governor of Connecticut; C. P. Neill, U. S. Department of Labor, Washington, D. C.; T. P. Sherman, Labor Committee of the State of New York; H. C. Bumpus, director American Museum of Natural History.

Women's Committee—Mrs. Douglas Robinson, honorary chairman; Mrs. W. Bayard Cutting, Mrs. Charles E. Hughes, Mrs. Seth Low, Mrs. George B. McClellan, Mrs. J. Pierpont Morgan, Mrs. Levi P. Morgan, Mrs. William Jay Schieffelin, Mrs. Lorillard Spencer, Mrs. I. N. Phelps Stokes, Mrs. Joseph H. Choate, Mrs. Grover Cleveland.

TANTALUM ORES.

Tantalum lamps are manufactured in small quantities, compared with carbon-filament lamps, chiefly because of the rare occurrence of the mineral. The great improvements which have recently been made in the tantalum lamp, and the almost common belief that the ordinary incandescent lamp must be superseded by a metallic-filament lamp, attract the attention of electrical engineers to the question concerning the production of minerals, and any new workings which are likely to increase the production of these minerals may have an important bearing upon the electrical industry. Thus, the discovery of tantalum ores in West Australia is a matter of much importance. The "Times Financial and Commercial Supplement" prints an interesting statement from a correspondent at Kalgurli, West Australia, dealing with the financial aspect of the question. Tantalum was first discovered in this State in 1894, when the rare mineral stibiotantalite (tantalate and niobate and antimony) was identified in the tin washes of the Greenbushes tinfield, near Bunbury. In 1900 tantalite (tantalate of iron) was discovered in the concentrates at the same place, and shortly afterwards large deposits of manganotantalite (niobate an tantalate of manganese) were found on the Wodgina tinfield. Wodgina is situated on the Pilbara goldfield, about 160 miles inland from Port Headland. The introduction of the Siemens and Halske tantalum light furnished a market for the mineral, and in 1905 over 70 tons, valued at £8,925, were exported. This ore contains from 68 to 70 per cent. of metallic tantalum. The bulk of these shipments were obtained by "dry-blowing," the alluvial consisting of decomposed pegmatite from the tantalum lodes. The mineral occurs in lumps varying in weight from a few grains to blocks of thirty-seven pounds weight. The market fell away towards the end of the year, and at present there is no official market obtainable for tantalum ores. Although it is popularly supposed that the only use to which tantalum has been placed is in the manufacture of filaments for electric lights, this is by no means the case, for tantalum possesses properties which render it an important factor in steel alloys. Tantalum is a hard grey metal, somewhat heavier than iron, and is markedly ductible. At the same time when hammered it becomes harder than the hardest steel, and has even been suggested as a substitute for diamonds in diamond drilling. It is not acted upon by air except at high temperatures, and is unaffected by all acids save hydrofluoric. It has been shown to alloy well with steel, and the alloys possess not only great hardness, but are also very tough. Only a very small percentage of tantalum is required in these alloys. The correspondent believes that Krupps are experimenting largely in this matter, and that they, or some other German firm, are making every effort to "corner" the Wodgina fields. He adds: "The present strangulation of the market is a means to that end. The tantalum mines are few in number, and the control of fully 70 per cent. of the ore in sight is vested in one company. There is no doubt that this control could be transferred to German hands tomorrow. It is simply a question of price. The presence of niobium in the mangano tantalite is no longer a prohibitive factor, as recent research has shown that the niobium may be completely separated. As yet the lode has not been proved in depth, as the surface deposits have more than sufficed for all present requirements." He concludes that the present drop in the price of tantalum is simply a market move designed to prelude the buying up of the leases in the Wodgina.

HARRIMAN AND THE SOUTHERN PACIFIC.

The Los Angeles "Examiner" prints the following story: Instead of declaring a dividend for the stockholders of the Southern Pacific Railroad in 1905, President E. H. Harriman ordered an appropriation of $5,000,000 for the purpose of electrifying the western division of the system, which is the old narrow-gauge route from Oakland by the way of Haywards and the Niles Canyon, through Alviso and San Jose ot Santa Cruz. In addition to this, $800,000 was appropriated to tunnel the Potrero of South San Francisco, and another $1,000,000 was taken to build a bridge across the Bay of San Francisco at Dumbarton Point. All of this work is now under way, and it is the starting point of the gigantic enterprise by which Mr. Harriman proposes to combine the electric road and power companies of Southern California and finally to give the Southern Pacific Company an electric line from Los Angeles to San Francisco.

To accomplish this Mr. Harriman, in addition to changing his narrow-gauge line to Santa Cruz into an electric line, secured control of the Santa Cruz & Watsonville Railroad, and the Watsonville, Salinas & Spreckles Railroad Company, and consequently came into ownership of a direct line from Oakland and San Francisco to Salinas, a distance of 128 miles, which is all to be electrified. The next move is the combination of the entire electric railroad systems and small steam railroads of this section and the extension of a line by this combination to Santa Barbara.

LONDON WATER CONSUMPTION.

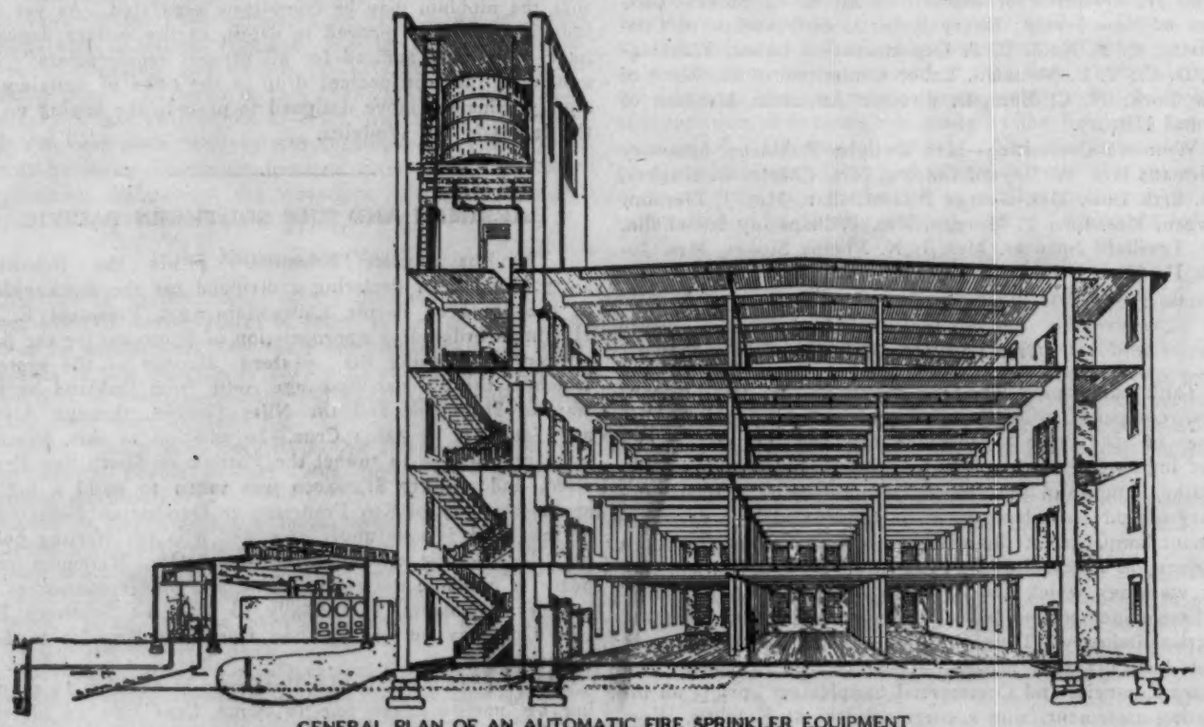
The average daily supply of water delivered to London from the Thames River during August last was 138,599,861 gallons; from the Lea, 42,085,000 gallons; from springs and wells, 67,077,451 gallons; from ponds at Hampstead and Highgate, 3,000 gallons. The daily total was therefore, 247,765,312 gallons for a population estimated at 6,840,367, a daily consumption per head of 36.22 gallons.

INDUSTRIAL

FIRE LOSSES ARE HEAVY.

Adequate fire protection has become a burning question with property owners. In the past sixty-five days upwards of $375,000 of lumber manufacturing property has been destroyed in the states of Washington and Oregon. In the same period proportionately heavy losses have been incurred in California, Idaho and British Columbia mills.

The quick destruction of property has naturally awakened apprehension and anxiety on the part of those having money invested in lumber and allied industries, and it is but a logical sequence that many are now devoting considerable time to a careful and comprehensive study of the general problem of fire protection; and, also, that many are installing automatic sprinkler system such as the Grinnell Automatic Fire Sprinkler service of the Pacific Fire Extinguisher Company, 145-153 Howard street, San Francisco.



GENERAL PLAN OF AN AUTOMATIC FIRE SPRINKLER EQUIPMENT

The disastrous fires of recent date are, without exception, of unknown source and occurred after the buildings had been closed for the night, for the noon hour, or for Sunday. The destruction of the property in each case is attributed to the fact that the flames got too good a start. That appears to be the correct explanation of all recent fires in this section. The records show that fires originating in working hours are seldom heavy losses, for the reason that the blaze is extinguished in its incipiency. So that with risk it largely is a question of the period of time elapsing between the beginning of the fire and the first application of water. Give the flames a handicap of a few minutes and it is almost a ten to one shot that the plant will be smoldering ruins, and and the reason for it is this:

A plant containing 540 tons of combustible construction will burn in three hours, or at the rate of about three tons a minute. To extinguish any fire that requires that water shall be applied with sufficient rapidity to take up the heat as fast as it is generated by the fuel. If the heating effect is greater than the cooling effect, the water passes into steam or is decomposed. One pound of fuel will evaporate from twelve to eighteen pounds of water. The plant which is consumed in three hours, burning at the rate of three tons a minute, calls for at least fifteen tons of water per minute. Comparatively few risks can supply it through the medium of an ordinary portable hose service.

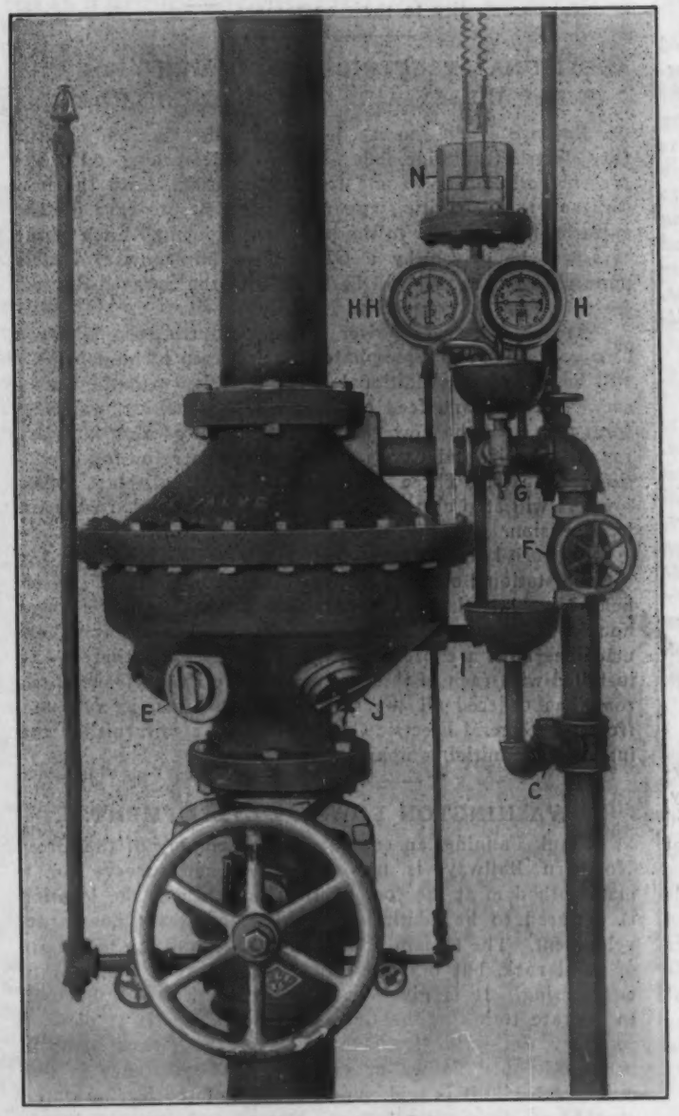
This is where the strong feature of an automatic sprinkling service recommends itself. It prevents a fire from gaining headway and simultaneously turns in an alarm at any given point. Men who have studied the fire question for years say that a properly arranged sprinkler service will furnish the best possible fire prevention and reduce insurance rates from 33⅓ to 50 per cent. if installed under the rules and requirements of the insurance companies.

An automatic sprinkler system consists of piping run along and underneath the roof and ceilings of buildings, the different lines of pipe being from eight to ten feet apart, with self-opening sprinkling valves every eight feet. These valves are held closed by metal alloy, which melts at a temperature

FULL SIZED SPRINKLER, OPEN

SPRINKLER CLOSED

SECTIONAL VIEW



GRINNELL DRY PIPE SYSTEM

of 155 degrees. Each valve when open will distribute water in a heavy shower over an area of 100 square feet. They do not open by fire, but by the spread of heat in advance of the fire. The piping of the system is connected with a double water supply, which may consist of an elevated tank and a steam fire pump, or a pressure tank and connection with a street water main. The vital points are adequate water supply and properly constructed equipment.

Over 100,000 buildings in the United States are equipped with automatic sprinklers and they have successfully extinguished over 10,000 fires, with an average loss of less than $250, as compared with an average loss of nearly $8,000 on similar risks unprotected.

GAS AND GASOLINE ENGINES.

The rapid advancement and future success of gas and gasoline engines is well evidenced and assured by the announcement of the DuBois Iron Works, DuBois, Pa., a $1,000,000 corporation, which has taken over the entire business of the Lazier Engine Co., including the patents and designs of the latter company. They have not only improved the engine in construction and design, but have made it possible to operate them on natural, illuminating, coke oven gas, gasoline, alcohol, distillate, crude oil and kerosene, in sizes ranging from 5 horsepower to 300 horsepower.

Mr. Peter Eyermann, one of the foremost gas engine authorities, designers, and engineers from Germany, where explosive engines of all types have been developed to a greater extent and achieved greater success in the larger horsepowers, is chief of the engineering department, and under his designs and supervision the new and improved "DuBois" will be produced.

The officers of the company are: Mr. John E. DuBois, president; Mr. W. C. Pentz, vice-president; Mr. E. A. Badger, secretary and treasurer; with Mr. I. N. Hamilton as general manager. The sales and advertising departments will be in the hands of Mr. C. E. Stuart.

The head office and entire management will be located at DuBois, Pa., and at Buffalo, which formerly was the Lazier Engine Mfg. Co. headquarters, a branch office will be retained, together with branches in the principal cities throughout the country.

IMPROVED TYPE JUNCTION BOX.

A new method of manufacturing junction boxes has recently been adopted by Frank B. Cook of Chicago. This box is made of sheet steel, heavily galvanized; making it very much lighter than the old painted cast-iron boxes. The difference in weight is so great that it will effect a material saving in freight. It also makes it much easier to handle on the pole and furnishes a most economical and simple means for installing and splicing main leads of cable and extending branches of smaller cable to other distributing points. It renders sleeve splicing or wiped joints unnecessary. It makes cable testing a very simple matter, as the box can be opened more easily than can a cable joint.

It is absolutely moisture-proof, and has a sliding galvanized sheet-metal cover which furnishes added protection. The junction box is equipped with self-soldering nozzles, and is made, as noted above, of galvanized sheet steel, a rubber gasket rendering the joint between the cover and the box, moisture-proof.

The box is galvanized after being formed up, so that the galvanizing will fill all the joints and make the box air-tight.

In order to make sure that the joint is moisture-proof, the junction box is subjected to an air pressure test before leaving the factory.

The bottom of the box is about two inches deep so that paraffine or a compound may be poured in to that depth, after the cable has been brought in and spliced. This is an additional protection to the cable against moisture.

Another feature of this box is that it can be furnished separate, or may be installed alone originally and the terminal can then be added at any future time.

All Cook junction boxes are equipped with self-soldering nozzles which are a great convenience and very economical as they save the services of an expert cable splicer or of a plumber to make wiped joints. All that is necessary is to scrape the lead cable sheath bright and clean before inserting it in the nozzle. To solder the cable, a blow torch is applied to the outside of the nozzle, first wrapping tape or paper around the bottom to prevent the solder from running out. The necessary amount of solder and flux is inside of each self-soldering nozzle.

ELECTRICAL EQUIPMENT FOR MINES.

The Boston & Montana Mining Company, of Butte, Mont., has contracted for five electric locomotives and a complete underground haulage system. The engines will cost about $2,000 each and are to be delivered in ninety days. They will be of the Baldwin pattern, with Westinghouse equipment. The installation of these engines and proper electrical appliances to operate them will do away with the present system of tramming. When the Boston & Montana began operations men were employed to do the tramming, but eventually horses were substituted and are now in use.

ELECTRIC HEATING DEVICES.

No one could witness the operating exhibit of electrically-heated tools made by the Vulcan Electric Heating Company, at the Chicago Electrical Show, without being convinced of the entire practicability of electric heating devices of all kinds.

The Vulcan Company displayed electrically-heated tools operating at temperatures considerably higher than attempted commercially by other companies. Red hot branding tools are now being sold by this company, and their soldering tools are well known as providing ample and continuous heat economically.

A red-hot branding tool was operated continuously during the exposition, in branding souvenirs, and was quite a center of interest and wonder.

A large soldering tool, used in running a heavy seam, was also a very prominent feature of the Vulcan exhibit. This tool eats up a heavy bar of solder in a moment. Its high efficiency and capability of doing heavy work is very convincing.

The soldering and branding tools and other specialties are applicable to a great variety of work by simply furnishing special tips. Adaptations were shown to waxing, electrotyping, glass leading, shoe burnishing, felt burning, etc.

It is believed that the convincing demonstrations made by the Vulcan Company will lend tremendous impetus to the electric heating industry, as it must be evident that the lower-temperature devices can be developed and operated with greater ease than these high-temperature tools.

The enterprise always shown here on the Coast may be depended upon to take advantage of this opportunity, and there is every reason to believe that the electric heating industry will rapidly advance into the first rank and take its place on a par with electric lighting.

Considering the fact that electricity insists on developing heat upon all occasions, oftentimes very much to the disadvantage of motors, dynamos and other appliances, and that many and expensive expedients are adopted for the prevention of heat where it is objectionable, it would seem that the utilization of this form of energy will be fully appreciated and taken advantage of.

There is no better opportunity for central stations to increase their day loads and, in general, to secure additional business, than in introducing this extremely useful and economical commodity to their customers.

ADDITIONAL ELECTRICAL EQUIPMENT FOR THE WEST JERSEY AND SEASHORE RAILROAD.

Because of the increased traffic on the Camden-Atlantic City electric trunk-line, it has become necessary to add to the present rolling stock some twenty-one cars. Both the new cars and the generating apparatus necessary to care for the extra load, are similar to the present equipment. Each of the cars will be driven by a GE-69 (200 horsepower) double motor equipment and will be fitted with the Sprague-General Electric Type M control.

At the Westville power house a fourth 2000 kilowatt, 6600 volt, 25 cycle, three-phase, Curtis steam turbo-generator will be installed. Additional boiler capacity with the necessary condenser and feed pumps, switchboards, etc., will also form a part of the new equipment, as well as a 75 kilowatt, 125 volt, horizontal Curtis steam turbo-generator for excitation purposes. Three extra 700 kilowatt, air-blast transformers will step up the generator voltage to 33,000 volts for transmission.

Six 1000 kilowatt rotary converters will be distributed in the sub-stations; one each at South Camden, Glassboro, Newfield, Mizpah, Atlantic City, an done at the Westville power house. The accompanying air-blast transformers for these machines have a capacity of 370 kilowatts each, three being installed with each of these rotaries. The Pennsylvania Railroad has ordered all the additional apparatus, as outlined, from the General Electric Company which also furnished and installed the initial equipment.

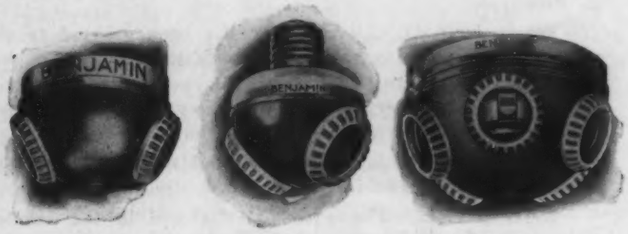
WASHINGTON POWER DEVELOPMENT.

Frank Fanning, an engineer in the employ of the Great Northern Railway, is making preliminary surveys for a mammoth dam at the foot of Big Lake, where the location is declared to be admirably situated for water power development. The stream point is not wide, and the banks are of solid rock, but otherwise offering no great obstacles to engineering. It is given out that the power will be used to operate trains in the Cascade Mountains. It is planned to carry the water from the lake to the power plant in mammoth open flumes or cylinders. The distance is two miles, and will, it is said, supply a head of 100 feet of water, capable of developing between 90,000 and 100,000 horsepower.

WIRELESS CLUSTERS—THEIR ADAPTATION TO BURNING TWO LIGHTS IN SERIES.

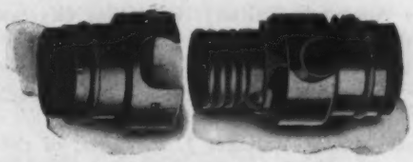
The Benjamin Electric Mfg. Co., Chicago, Ill., has placed upon the market a new line of devices in an adaptation of their wireless clusters to burning two lights in series.

Recent changes in the incandescent lamp situation, brought about by the use of metal filaments, have well-nigh established as standard, voltages of 120 and 125. In many cases where the wiring installation includes 220 volt circuits, there is therefore an increased demand for devices in which two lamps may be burned in series.



CUT 1 CUT 3 CUT 5

No. 22½ (cut 1) serves the general purpose of a two light device for ordinary cluster purposes. No. 92½, receptacle plug (cut 3), is furnished for 220 volt circuits wired in multiple, where it is desirable to use 110 volt lamps.



CUT 4

No. 412½, twin socket (cut 4), has heretofore been furnished for multiple work only. This can now likewise be used to burn two lamps in series. The device is largely used for show window lighting. Lamps may be placed parallel to the surface to which the socket is attached. The socket can also be used for fixture work with lamps placed either in a vertical position or in a horizontal position surmounted by half shades.

A B

Diagram A applies to all of the aforementioned two light series devices.

C D

For clusters ranging from 4 to 6 lamps, No. 15½ (cut 5) may be used as shown in the three diagrams, B, C, and D, permitting, first, the use of four lamps on two different circuits (cut B), two lamps in series on each; second, the use of four lamps on one circuit, two in series (cut C); or again, third, with six lamps in a series—parallel grouping, consisting of three sets of two lamps in series (cut D).

The San Francisco office of this company is No. 156 Minna street.

EARNINGS OF UNITED RAILROADS OF SAN FRANCISCO FOR YEAR AND STATEMENT FROM PRESIDENT THALMANN.

The gross receipts of the United Railroads of San Francisco for 1906 were $5,941,000, a loss of approximately $1,116,000, compared with the year 1905. The gross passenger receipts for December were $556,000.

President Thalmann, of the United Railways Investment Company, which controls the stock of the United Railroads of San Francisco, says: "The officers and directors of the United Railroads are confident that the rebuilding of San Francisco will go forward with continued vigor. The report that the labor situation is steadily improving, and that the company now has no difficulty in obtaining all the labor necessary for the reconstruction of its old cable lines, several of which have been completed, and the entire work of reconstruction will be finished by Spring.

"The delivery of the 250 new cars which were ordered by the company has begun, and when they are placed in the service the company should be as well equipped as any street railroad property in America. The new construction has been of the highest order. The officials of the company report a most favorable outlook for this year's business. It is confidently believed that the earnings for 1907 will exceed those of 1905."—From "Street Railway Journal."

NATIONAL ELECTRIC LIGHT ASSOCIATION COMMITTEE TO FORMULATE MODEL CONTRACT AND SPECIFICATIONS FOR STREET LIGHTING.

A new committee, appointed by President Williams of the National Electric Light Association, has been created for the purpose of formulating a model contract and specifications for street lighting. A great many inquiries have been made for such a contract—one that would be fair both to the lighting company and to the municipality, and one that would permit of changes in the form of illumination, as new developments were made in the art, on a basis satisfactory to both parties to the contract.

The personnel of the committee is exceptionally strong, the members being Dudley Farrand, Louis A. Ferguson, Paul Spencer, Charles P. Steinmetz and A. E. Kennelly, and very happy results are looked for in the report to be presented at the thirtieth convention of the association to be held in May or June next.

WATER POWER DEVELOPMENT IN THE SOUTH.

The water-power developments of the Southern Power Company in the Carolinas have become famous as being among the most extensive and most carefully executed enterprises of the kind in the country. The Southern Power Company's mains will, when their developments are complete, cover many hundreds of square miles of the "Piedmont Region" with a network of transmission lines for furnishing power for cotton mills and light for the towns and cities of the district.

The City of Statesville, N. C., has recently purchased three 500-kilowatt, Allis-Chalmers Power Transformers for use on the Southern Power Company's circuits, which supply the city at primary voltages of 40,000, 20,000 and 10,000 volts. The secondary voltages for use in Statesville will be 2,300 and 575 volts.

NEWS NOTES

POWER AND LIGHT PLANTS.

Baker City, Ore.—The council has awarded contract to the Baker Light & Power Co. to furnish electricity for lighting the city for one year. The city is contemplating the erection of a municipal electric light plant next year and to utilize the water power from its gravity water system.

Boise, Ida.—Guy C. Barnum, of Shoshone, has sold his interest in Thousand Springs Land & Transportation Co. to A. M. Harris. The company is building a power plant in Lincoln that will develop 12,000 horsepower.

Cheyenne, Wyo.—The Northern Colorado Power Co., which purchased the plant of the Cheyenne Light, Fuel & Power Co., is contemplating the erection of a new electric plant. Estimated cost, $1,000,000.

Kalispel, Mont.—The interest of the Tinkels and Conrads in the Big Fork Water Power plant has been taken over by the Flathead Valley Power Co. $50,000 will be expended in improvements at the Big Fork plant. 2,000 horsepower will be developed. C. T. Moffett, manager.

Livingston, Mont.—The Livingston electric light plant has been sold by J. L. Bright to Henry F. Kroyer, of New York. M. Hebgen, superintendent of the Butte Electrical works, will supervise the work of extending the power from the Madison River Power Co.'s lines to connect with the plant here.

Pineville, Ore.—Bids will probably be received in May or June for the construction of a plant for the Pringle Falls Electric Power & Water Co., to cost about $200,000. W. H. Huston, engineer; L. B. Lafolett, secretary.

Columbia, Wash.—The council is now considering a petition presented to it asking that a franchise to furnish the city with one hundred gas lights for $20 a year each be given to H. C. Miller.

Coeur d'Alene, Ida.—The W. W. P. Co. has a surveying party here surveying for a power transmission line from Spokane to the Coeur d'Alene district.

Edmonton, Alta.—It is proposed to install at the electric light plant a 1,000-kilowatt, three-phase, sixty-cycle, 2,400-volt turbo-generator set (steam) auxiliaries. R. R. Kelly, city engineer.

Grace, Ida.—The Telluride Power Co., Salt Lake City, will erect a new power plant in this city at a cost of $1,000,000.

Spokane, Wash.—The Spokane Merchants' Police and Detective Agency is soon to install the most up-to-date system of police patrol signal boxes in existence, states W. E. Stauffer, president of the Merchants' Police.

Bremerton, Wash.—Authority has been received to proceed with the erection of a central power plant at the yard, and allowing $178,000 with which to begin the work.

Coeur d'Alene, Ida.—Council granted a gas franchise to Frank Price and associates, of Spokane.

Corvallis, Ore.—Council adopted a resolution that bonds of the city be issued in the sum of $10,000 for the construction of a municipal light plant.

Chesaw, Wash.—J. Shaw contemplates installing an electric light plant at this place.

Juneau, Alaska—The Reynolds-Alaska Development Co. has installed a complete electric equipment on La Touche Iron Mountain Mine on Prince William Sound.

Prineville, Ore.—The Prineville Light & Water Co. is considering the proposition of putting in a power plant on the Deschutes River.

Rosalia, Wn.—Council has granted a franchise for an electric lighting and power plant to the Spokane & Inland Empire Ry. Co.

Starbuck, Wash.—The Starbuck Electric Light & Power Co., with $10,000 capital, by M. Pretizyoki, A. C. Warren and Z. Pietizyoki.

Washington, D. C.—Authority has been granted to the reclamation service by the secretary of the interior to purchase under competitive proposals the necessary equipment consisting of machinery and its utilization at the tunnel headings and other points on Tieton irrigation project.

Coeur d'Alene, Ida.—John Carr and associates have applied for a gas franchise.

Helena, Mont.—The gates were closed in the Hauser Lake dam. It will be three weeks before the power is turned on, as it will take this time for the lake to fill. The water will back up eighteen miles in the river and through the Prickly Pear Canyon, six miles in the valley below Helena. The dam is 640 feet long and seventy feet wide, and is made of steel throughout. Fifteen thousand horsepower will be generated. The power will run the Washoe Reduction Works, the Anaconda Railway, light that city, and operate many of the Butte mines.

Ketchikan, A.—The electric lighting plant recently destroyed by fire will be rebuilt at once. New machinery has been ordered.

Missoula, Mont.—Manager J. A. Jones, of the Missoula Gas Co., states a site has been purchased for the gas plant. The building will be constructed of concrete blocks, and will cost $7,500.

Missoula, Mont.—Mr. Wethey, of the Missoula Light & Water Co., states the company will enlarge the power house. Three 800-horsepower turbines will be installed.

Portland, Ore.—The Portland General Electric Co. has applied for a permit to construct conduits and lay wires underground.

Spokane, Wash.—G. W. Armstrong states that work on the new gas plant will be commenced early in the spring. Ten miles of mains will be laid this year.

Sarcoxie, Wyo.—The Sarcoxie Electric Light & Milling Co. has increased its capital stock from $7,500 to $16,500.

Petaluma.—The annual meeting of the stockholders of the Petaluma Water and Power Company was held January 7th. The old board of directors was re-elected, as follows: A. B. Hill, H. T. Fairbanks, H. E. Lawrence, Conrad Poehlmann and M. Doyle, and the board reorganized by re-electing A. B. Hill president; H. T. Fairbanks, vice-president, and Fred W. Heseker, secretary and superintendent. During the past year the company has expended a large amount in the improvement of the local water system, and will expend a far greater amount during the present year.

Fernie, B. C.—The Crow's Nest Pass Coal Co. will erect a large power plant here during the winter. Address General Manager Lindsay.

Portland, Ore.—The Portland General Electric Co. has been granted a franchise for a steam heating plant to cost about $300,000.

San Francisco.—The Farmers Light & Power Company, has filed articles of incorporation with the County Clerk. The corporation has an authorized capital stock of $2,000,000, and will deal in electricity for lighting and power. The directors are: H. D. Colyar, Olin L. Berry, F. E. Brady, G. W. Miller, C. W. Doble and John Royles.

ELECTRIC RAILWAYS.

Palouse, Wash.—The Spokane & Inland has a crew at work on the framework of the big viaduct which is to be built across Main Street and the Palouse River, from the depot to the warehouse district, a distance of 940 feet. Another crew is excavating for the new $18,000 depot which will be built in the Spring. The main building will be 60x60 feet, and at the rear will be the freight shed, 36x100 feet.

Seattle, Wash.—The Seattle Electric Co. was granted a franchise to lay tracks on Taylor Avenue, around Queen Anne Hill, on Third Avenue So., and on Prefontaine Place. The company plans to build 40 miles of new tracks during the present year.

Seattle, Wash.—Merle J. Weightman states that the new Seattle-Tacoma interurban line is financed, and construction will begin by May 1st.

Spokane, Wash.—The Spokane & Big Bend Ry. Co. has closed a deal with Jay P. Graves and associates to run its cars in and out of Spokane over the new Graves line, which is soon to be built down the river. The Big Bend Co. is also to procure its power from the power plant being constructed by the Graves Co., near Nine-mile Bridge.

Tacoma, Wash.—Contractors for the Pacific Traction Company have a crew of men at work on the company's underground crossing at the junction of its American Lake line and the Northern Pacific tracks.

Tacoma, Wash.—Work has been commenced on the installation of the "S" tracks being laid by the Tacoma Ry. & Power Co., at C Street and Jefferson Avenue.

Tacoma, Wash.—C. E. Muckler, of Tacoma, and Merle J. Wightman filed acceptance with the county commissioners of the franchise granted them for their line of interurban electric road from this city to the King County line en route to Seattle.

Spokane and Big Bend Railway—Col. W. H. Plummer, president, announces that traffic arrangement has been made with Jay P. Graves, president of the Spokane and Inland Empire system, to run its cars in and out of Spokane over the latter's line, to be built to Seven Mile Bridge, also that a line will be constructed to Davenport, 37 miles. Grading is to be begun at once. A syndicate at St. Louis, Mo., it is announced, will finance the project taking $2,500,000 in five-per-cent., ten-year bonds, certified by the Spokane & Eastern Trust Company. The line will tap the Big Bend country, the richest wheat belt in Eastern Washington.

Spokane and British Columbia—H. W. Warrington, chief engineer and general superintendent, in Spokane, said that construction work is in progress on the line from Grand Forks, B. C., north to the mining camps at Franklin. The road is operating from Republic, Wash., to Grand Forks, 40 miles, and with the completion of the Franklin branch, up the north fork of the Kettle River, will have 90 miles of road in operation. The extension from Republic to Spokane will follow.

Washington Water Power Company—Harry M. Richards, president, announces that plans are making for increasing the company's electric plants to 10,000 horsepower using the waters of the upper and lower falls in Spokane; 50,000 horsepower, Post Falls, in the Spokane River in Idaho; 15,000 horsepower and a stream auxiliary plant of 6,000 horsepower. The company proposes increasing its capital from $5,000,000 to $10,000,000 at a meeting of stockholders called for March 4.

Columbia and Walla Walla and Traction.—J. H. Morrow, general manager, and promoter of the Farmers' line between Dayton and Wallula, by way of Walla Walla, Milton and Freewater, says farmers along the line are donating land for right-of-way, and the contracts will be let in a short time.

United Copper Company—Announcement is made that the survey of the line from the mines at Chewelan to the Spokane Falls & Northern yard, six miles, has been completed, and that the grade will be better than was expected. Work will begin next Spring.

Monterey, Cal.—The survey of the Monterey and Fresno Railway is progressing. There are four gangs in the field. The party working from this end is nearly to the Salinas River. Another party is working out of Fresno toward the Los Aiglas Pass. At Los Aiglas Pass there is a party of surveyors on each side of the mountains. At Hollister the officials of the Monterey and Fresno Railroad applied for a franchise through that city. Next week a franchise will be asked at Fresno.

Spokane & Inland Empire System—J. B. Ingersoll, general manager, has placed an order for 250 box cars with the Seattle Car Company, for delivery prior to July 31. The cars are of the 40-foot type with 80,000 pounds capacity. He will also place orders in a short time for 12 Brill passenger coaches and 50 flat cars. With these the company will have 450 freight cars in commission.

Boise, Ida.—The county commissioners have granted a franchise to W. D. Kenyon, Paul R. Kartzke and J. C. Rogers to build an electric railway from the Snake River at this place, to the town of Oakley, a distance of 25 miles.

Cheney, Wash.—Engineer Andrews, of the Cheney electric line, reports that work is progressing rapidly on the uine between this place and Hayford. Five construction camps are established.

Caldwell, Ida.—C. J. Franklin, of Boise, supervising engineer of the new Boise and Caldwell interurban railway, is here inspecting the new steel bridge across the Boise River at this place.

Washington Water Power Company—D. L. Huntington, general manager, announces that a party is surveying for a power transmission line from Spokane to the Coeur d'Alene Mining District, 40 miles, this doubling the present service of 4,000 horsepower.

Helena, Mont.—It is reported that plans are on foot for the construction of an electric railway from this place to Butte, a distance of 53 miles.

Portland, Ore.—C. E. Loss announced that the United Railways has placed orders for $130,000 worth of steel rails. The extension to the city lines alone will cost $850,000, and it is the intention to build an interurban track to Hillsboro and Forest Grove.

San Francisco, Cal.—Reports are in circulation regarding the organization of a new company, which proposes to put up a hot fight for the street railway traffic of this city. The report is that a company of Los Angeles capitalists is to be supported in the project of building an electric street car system across town, through the busy manufacturing districts, in competition with the United Railroads. For some time a committee of the Potrero Commercial and Manufacturing Association has been engaged in an attempt to secure better street car service through the manufacturing districts on the water front, as there are between 50,000 and 60,000 workers who must be taken care of. At present the facilities are meager, and another effort will be made to secure recognition for the Potrero.

Watsonville, Cal.—J. B. Rogers, chief engineer of the Ocean Shore Railroad, says that the Ocean Shore will be completed as a single-track line from San Francisco to Santa Cruz by October 1st. Nearly 67.5 per cent of the grading and 85 per cent. of the necessary fills and bridge approaches have been completed. He says: "The road is in good hands. Eighty per cent. of the stock is owned in San Francisco by men who are heartily interested, not alone in the construction of this line, but in seeing that it is maintained in local hands."

San Francisco, Cal.—Judge Edward Whitson, sitting in the U. S. Circuit Court, yesterday issued a temporary restraining order in the case of the San Jose Railroad Co. against the San Jose and Los Gatos Railroad Co., enjoining the defendants from constructing a street railroad along San Fernando Street, between Second and Market Streets, San Jose, and running cars there. The defendants have been ordered to show cause, on Monday, February 4th, why the injunction should not be made permanent.

TRANSMISSION.

Redding, Cal.—J. A. Whitehead has deeded to the Pacific Power Co., for $10, sections 16 and 17, township 30 north, range 1 east; sections 19 to 30, township 30 north, range 1 west; sections 25, 26, 27, 32 and 33, township 30 north, range 2 west; a right to 40,000 inches of Battle Creek water, measured under a 4-inch pressure; a right to 20,000 inches taken from Baldwin Creek; a right to 15,000 inches taken from North Battle Creek; a right to 10,000 inches taken from South Battle Creek; a right to 6,000 inches from Carrah Creek, and 15,000 inches from the north fork of Battle Creek.

San Francisco, Cal.—The Risdon Iron Works has secured a contract with the Union Construction Co. for the entire hydraulic equipment of the plant of the Stanislaus Electric Power Co., with the exception of the water wheels and connections. The contract with the Union Construction Co. calls for two riveted steel pressure pipe lines, each approximately 3,800 feet in length, each line being 48 and 38 inches inside diameter. The Risdon people have the contract for the riveted steel header and connections, connecting the two pressure pipe lines to the water-wheel units. Also the contract for the mine pipe line on the opposite side of the river, leading from the power house to the top of the hill, for supplying mines with water from the power plant. The total length of the mine pipe is, approximately, 5,300 feet. The pipe lines will operate under a total head of 1,500 feet, or about 651 pounds per square inch. The diameters of the mine pipe line are 31 and 37 inches. The thicknesses of the riveted steel pipes in the pressure pipe lines and the mine pipe line and header vary from ¼ to 1 inch. The total tonnage of the hydraulic equipment under contract with the Union Construction Co. will approximate 2,500 tons.

Winnemucca, Nev.—The Western Pacific Railway Co. will install an electrical plant at Flower Lake Tunnel and use the power to run drills and light the tunnel.

INCORPORATIONS.

San Francisco, Cal.—The Nevada Oil and Development Co. has been incorporated with a capital stock of $50,000, by Milton Sprague, C. A. Roller, J. A. Campbell, E. E. Kindelspierre and Chas. Downing.

San Francisco, Cal.—The Pryal-Shean Electric Co. has been incorporated with a capital stock of $25,000, by C. L. Pryal, W. F. Shean and H. L. Horn.

Sacramento, Cal.—The Sacramento and Vallejo Railroad Co., backed by Sausalito and San Francisco men, has been incorporated to connect Sacramento and Vallejo by the most direct practicable route. It has not been decided whether or not the road will be operated by steam or electricity, but it will enter the corporate limits of each city and will be about 60 miles in length. Attorney Frank P. Deering, counsel for the new corporation, states that the construction of the road in the immediate future is assured and that men are already in the field securing a right of way and surveying the proposed route. The company is capitalized at $1,000,000, of which $60,000 has been subscribed and $6,000 paid up in cash. The directors are: Lucian W. Knight, of Sausalito; Benjamin Pringle, of Sausalito; and William G. Barr, of San Francisco.

Los Angeles, Cal.—The Farmland Water Co. has been incorporated with a capital stock of $75,000, by M. G. Fogg, A. L. Dewey and Myron Westover.

San Diego, Cal.—The San Diego Rapid Transit Co. has been incorporated with a capital stock of $50,000, by R. A. Smith, T. L. Lewis, R. B. Thomas, G. Y. Gray and E. W. Peterson.

Los Angeles, Cal.—The Creedmoor Land and Water Co. has been incorporated with a capital stock of $30,000, by F. W. Pitcher, N. E. Rice, J. M. Larraide, E. G. Wood and C. I. Parker.

FOR GAS COMPRESSORS see RIX C. A. & D. CO., S.F.

CLASSIFIED LIST OF ADVERTISERS

Air Compressors
Henshaw, Bulkley & Co.
Hunt, Mirk & Co.
Platt Iron Works
Rix Comp Air & Mach. Co.

Alternators
Allis-Chalmers Co.
California Electrical Works
National Electrical Co.

Aluminum Electrical Conductors
Pierson Roeding & Co.

Annunciators
Aylsworth Co., H. G.
California Electrical Works.
Century-Klein Electric Co.
Patrick, Carter & Wilkins Co.
Tel. and Elec. Equipment Co.

Asbestos Products
Johns-Manville Co., H. W.

Automatic Sprinklers
Pacific Fire Extinguisher Co.

Batteries, Primary
California Electrical Works
Electric Appliance Co.
Gould Storage Battery Co.
Standard Electrical Works
Tel. and Elec. Equipment Co.
Western Electric Co.

Batteries, Storage
Century-Klein Electric Co.
Gould Storage Battery Co.
Electric Storage Battery Co.

Blue Printing
Dietzgen Co., Eugene

Boilers
Henshaw, Bulkley & Co.
Hunt, Mirk & Co.
Keystone Boiler Works
Moore, C. C. & Co., Inc.
Risdon Iron Works
Standard Electric Works
Tracy Engineering Co.

Boiler Compounds
Dearborn Drug & Chem. Wks.
Johns-Manville Co., H. W.

Buffers
Northern Electrical Mfg. Co.

Chemists and Chemical

Building Material
Johns-Manville Co., H. W.

Building Paper
Johns-Manville Co., H. W.

Circuit Breakers
Cole Co., John R.
Electric Appliance Co.
Fork Wayne Electric Works
Kilbourne & Clark Co.
Century-Klein Electric Co.

Compressed Air
Electric Manufacturing Co.
Pacific Elec. Mfg. Co.

Condensers
O. C. Goeriz & Co.
Rix Comp Air & Mach. Co.
C. H. Wheeler Mfg. Co.

Conduits
American Circular Loom Co.
American Conduit & Mfg. Co.
Aylesworth, H. G.
Cole Co., John R.
Electric Appliance Co.
Century-Klein Electric Co.
Tel. and Elec. Equipment Co.

Conduit Fixtures
American Conduit & Mfg. Co.
Aylesworth, H. G.
Electric Appliance Co.
Century-Klein Electric Co.
Tel. and Elec. Equipment Co.

Cooling Towers
O. C. Goeriz & Co.
C. H. Wheeler Mfg. Co.

Cross Arms
Carter & Co., George E.
Electric Appliance Co.
Century-Klein Electric Co.
Tel. and Elec. Equipment Co.

Draftsmen
Eureka Drafting Room

Drawing Materials
Dietzgen Co., Eugene
Leitz Co., A., The

Dynamos and Motors
Allis-Chalmers Co.
Brooks-Follis Elec. Corp.
California Electrical Works
Century-Klein Electric Co.
Electric Manufacturing Co.
Fort Wayne Electric Works
General Electric Co.
Kilbourne & Clark Co.
Northern Elec. Mfg. Co.
Standard Electrical Works
Tel. and Elec. Equipment Co.
Westinghouse Elec. & Mfg. Co
Wagner Elec. Mfg. Co.

Elevators
Van Emon Engineering Co.

Electric Car Heaters
Johns-Manville Co., H. W.
Northern Electrical Mfg. Co.

Electric Grinders
California Electrical Works
Northern Electrical Mfg. Co.
Tel. and Elec. Equipment Co.

Electric Heating Devices
Johns-Manville Co., H. W.

Electrical Instruments
Cole Co., John R.
Cutter Co., The
Electric Appliance Co.
Century-Klein Electric Co.
Fort Wayne Electric Works
General Electric Co.
Kilbourne & Clark Co.
Stanley-G. I. Elec. Mfg. Co.
Tel. and Elec. Equipment Co.
Westinghouse Elec. & Mfg. Co.
Weston Elec. Instrument Co.

Electrical Machinery
California Electrical Works
Northern Electrical Mfg. Co.
Standard Electrical Works
Century-Klein Electric Co.

Electric Polishers
Northern Electric Mfg. Co.

Electric Railway Appliances
Pierson, Roeding & Co.
Johns-Manville Co., H. W.

Electrical Supplies
Aylesworth Co., H. G.
Bay Shore Elec. Const. Co.
California Electrical Works
Century-Klein Electric Co.
Standard Electrical Works
Tel. and Elec. Equipment Co.

Electric Ventilating Fans
Century-Klein Electric Co.
California Electrical Works
Northern Electrical Mfg. Co.

Engines, Boilers, Heaters, etc.
Allis-Chalmers Co.
Henshaw, Bulkley & Co.

Electric Watchman's Clocks
Pacific Fire Extinguisher Co.
Tel. and Elec. Equipment Co.

Engineers, Chemical
Smith, Emery & Co.
Moore & Co., Chas. C., Inc.
Ohmen Engine Works
Standard Elec. Works
Tracy Engineering Co.
Westinghouse Machine Co.
Hunt, Mirk & Co.

Engines, Gas and Gasoline
Allis-Chalmers Co.
Henshaw, Bulkley & Co.
Moore & Co., Chas. C., Inc.
Westinghouse Machine Co.
Hunt, Mirk & Co.

Engineers and Contractors
Brooks-Follis Elec. Corporat'n
Bay Shore Elec. Const. Co.
Byllesby & Co., H. M.
California Electrical Works
Cannon, Edward F.
Century-Klein Co.
Cole Co., John R.
Copeland, Clem A.
Doble Co., Abner
Cory, C. L.
General Electric Co.
Hunt, Dillman, Meredith & Allen
Hall, Leon M.
Hunt, Mirk & Co.
Jackson, D. C. & W. B
Kilbourne & Clark Co.
Smith, Emery & Co.